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Coal-dust Firing for Reverberatory Furnaces

The Powdered Ash Introduces a Number of Complications and Renders the Attachment of Waste-heat Boilers Problematical

BY CHARLES F. SHELBY*

The discussion of the use of pulverized coal in reverberatory furnaces occurs, in so far as I am concerned, somewhat prematurely, because our studies at Cananea have not reached the final stage of successful operation which would furnish proof of the conclusions drawn from those experiments. But in response to repeated requests, and because discussions of the subject have been published in recent numbers of the JOURNAL, with direct reference to the experiments made at Cananea, a result of the observations to date are here presented, with the reasonable assurance on my part that the future will verify in substance the theories advanced.

In the JOURNAL of Feb. 1 is an article by Edward G. Thomas under the heading, "Coal Dust Firing of Reverberatory Furnaces," in which he takes exception to a paragraph in an editorial under the same heading in the JOURNAL of Jan. 18, wherein it is stated that the firing of reverberatory furnaces in this manner may preclude the attachment of steam boilers for the utilization of waste heat from these furnaces. While I must take exception to Mr. Thomas' article in a general way, still I cannot take the positive stand that waste-heat boilers cannot be used with coal-dust-fired reverberatories. There is no question that the difficulties incident to the manipulation of the furnace will be greatly increased by the presence of boilers, and very likely to such an extent that, taken together with the fact that a properly designed reverberatory furnace for this sort of firing will not have as much waste heat as the ordinary grate-fired reverberatory, it is possible that the boilers will not be of sufficient consequence to warrant their installation and the care they would require.

SOME OF THE DIFFICULTIES

When we first undertook to test the burning of coal in the form of dust we had no encouragement from anyone except the manufacturers of pulverizing machinery. All kinds of difficulties were prophesied by those who had practical experience in the application of coal-dust fire in other lines, as well as from those who had witnessed, and one who had taken part in, the experiment at the Highland Boy plant, where it was finally abandoned. Certainly most of these troubles were realized as well as others which had not been predicted, and after endeavoring for a month to make the furnace and boilers work in harmony as a unit, we came to the conclusion that we had better first learn how to smelt flue dust with coal-dust firing, and to leave for later consideration the generation of steam from any waste heat that might result from the process. This move in itself proved to be of great importance in reaching our final conclusion, which is that we have solved the problem, even though we have as yet no continuous record of complete success to illustrate the correctness of our solution.

Mr. Thomas is entitled to his opinion on the subject; and we may call both his and that of the JOURNAL theories. A theory is a logical deduction from a hypothesis, but not supported by an experimental demonstration; when it has this support it ceases to be a theory and becomes a law. Considering that there are no reverberatory furnaces at present fired with coal dust and utilizing the waste heat to generate steam, and also that the practice has been abandoned at the only two plants where it has been tried, even though it may be only a temporary abandonment, I think on the whole the JOURNAL has the better side of the theory at the present time.

Mr. Thomas makes the statement, that when the flues leading from the furnaces to the boilers were clean, at Cananea, "no trouble was encountered." As a matter of fact the flues never were clean after the pulverized-fuel plan was put into operation, excepting for short intervals directly at the start, and afterward, when the gases had to be deflected out of the furnace at any convenient point, in order to allow men to get into the flue and clean it out in good "armstrong" fashion. The possibility of providing this flue with hoppers and side doors for cleaning out the deposited ashes as mentioned by Mr. Thomas, was a suggestion of mine made to the person from whom Mr. Thomas has gathered his information. This information is, on the whole, more or less incorrect, although undoubtedly made in good faith. Mr. Thomas' informant spent only a short time at Cananea, and it is impossible for any person entirely unfamiliar with the details of the smelting business to master all the points that came up in connection with the experiment in a brief visit.

DISPOSAL OF THE ASH

If the flues were provided with hoppers, the hoppers would certainly fill up, but the material would never run out at the bottom except possibly in liquid form, if the temperature could be got high enough for that purpose, and one might as well put doors in the side of a blast furnace and rake out the slag and matte as to rake out the clinkered ashes that accumulated in this flue. The accumulated masses are not entirely liquid, it is true, but while the furnace is in operation and the flue is hot they are in a viscous, semi-fluid condition. Most of the semi-fused ashes will cool to a substance resembling pumice stone, but the bottom layers become as hard and dense as cold slag. Mr. Thomas mentions this "porous clinker of considerable strength," and states in the way of a remedy that the ashes remain as light, flocculent particles for at least an hour or two, and that if periodically cleaned out while in this condition they should offer no trouble, leading one to infer that they begin to clinker only when they are left in longer. These clinkers have been found to extend for a distance of fully 50 ft. from the reverberatory throat at Cananea, when the furnace was receiving only about 1½ tons of coal per hour, containing 18 per cent., or 540 lb. of ash, a large portion of which was deposited in the furnace itself and a substantial portion passing on through the flues and out of the stack. It can, therefore, readily be seen that within a period of an hour or two there would hardly be any of these light flocculent particles scattered over the large area to clean out until they would commence to agglomerate.

My observations lead me to believe that these particles have a sticky consistency all the time, almost from the moment they are formed, until they are cooled down below their melting temperature; in our study of this condition one of the most important and one of the first observa-

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tions that we made was that these particles of ash did not adhere to the roof of the furnace itself, where the temperature was hottest. It would seem, therefore, that the temperature must be lower than that of the furnace before they commence to agglomerate, at a point which we may for convenience call the "critical temperature."

Were boilers installed it would certainly cool the gases and ash particles, and if the proper efficiency were obtained from the boilers, the temperature of the ash particles would fall much below the viscous point. In passing through the "critical temperature" the particles would undoubtedly collect and commence to build up on the foremost tubes of the boiler and the surrounding brickwork and would have to be continuously removed and, I should think, by mechanical means. Moreover, considering all things, about the only logical place to put the boiler would be so near to the furnace as to be almost in it, introducing, as one can see, other complications of construction and operation.

When we finally did away with this flue and built the present short stack directly at the throat of the reverberatory we reduced these troubles considerably; but whenever any mechanical difficulty with one of our pulverizing machines occurred, the temperature could not be kept up in the furnace, and the ash would commence to deposit on the roof and on the side walls directly at the throat of the furnace and tend to close this up.

Condition of the Roof

Mr. Thomas also makes the remark that the roof of the furnace was in a very serious condition when the pulverizers were installed, and that shutting down the furnace and immediate repairs were contemplated; and that after the installation of the pulverizers it was not found necessary to shut down the furnace at all. Where this is in error is in reference to the condition of the furnace and in the location of the trouble. The furnace had been operated for a long time, and the side walls at the slag line were certainly in need of repairs; but it was decided to keep patching it up and not shut the furnace down until we had educated ourselves in the art of pulverized-fuel firing. Later on, when the suspension of operations was known to be necessary every attempt was made to keep the furnace in operation until that time, when the furnace could be shut down with the rest of the plant and when repairs could be made at leisure in a substantial and comprehensive manner.

With the class of coal that we had been using in the furnace it was necessary to use a forced blast through the grate, and the flames naturally impinged against the roof directly over the fire-box with a deteriorating effect. The condition of the furnace at this point was, however, not at all serious, and as previously stated, was not the important consideration for which the furnace was to be repaired. The pulverizers by introducing a flame in line with the longitudinal axis of the furnace will, as Mr. Thomas states, have less effect on the roof than a flame which is introduced at right angles to it; but firing with either gas or fuel oil would produce the same result. What Mr. Thomas means by "barring down" a reverberatory furnace I do not understand, unless it be what we term grating.

In a letter written to A. H. Wethey, of Butte, Mont., on Nov. 16, 1907, in response to an inquiry about this experiment, I gave a review of the progress made at that time. The following are the facts substantially as stated to him:

The Conditions

The reverberatory furnace at this plant was patterned somewhat after those in use at Anaconda, inasmuch as the hearth is 100 ft. long and 19 ft. wide, but the roof is higher than that of the Anaconda furnaces and the "verb," or throat, smaller. The boilers are located some distance from the furnace and the gases must pass through a long and tortuous flue before being delivered to the three 400-h.p. Stirling boilers, which are arranged in parallel.

This furnace has been in use about 18 months, treating principally blast-furnace flue dust. By reason of our using an oxidized iron ore in the blast furnace charge that contains an appreciable amount of fines, the flue dust is self-fluxing for the reverberatory furnace and a very desirable material.

We have two classes of coal available; one, a semi-bituminous coking coal analyzing about 18 per cent. ash, and the other a lignite coal with about 8 per cent. ash. The ash in both cases is practically silica plus alumina. The first coal represents our standard class throughout the entire camp and contains more B.t.u. than the second. Neither one of these coals alone is adaptable to a furnace of this kind with the regular fire-box. The first coal has a short flame, and its strong coking qualities render the bed so pasty on top and so full of large clinkers below that fully two hours in each eight-hour shift are lost in getting the grate in shape; and it takes a corresponding length of time to bring the furnace back to the proper heat. This means a 50-per cent. loss of time. With the second coal used alone the flame is terrific immediately after dropping in the coal, and dense volumes of black smoke and unconsumed carbon pass out of the stack 200 ft. away. The coal also breaks up in the fire-box to such an extent that it will go through the grate bars no matter how close together they are, until they are placed so close as to almost choke off the draught entirely. This means a loss of coal or no business in the furnace.

Mixing these two coals gives fairly good results, but the best we have ever been able to do is to maintain an average capacity, over a period of a month, of 150 tons per day. The mixing of the coal, however, involves difficulties and annoyances due to the necessity of an accumulation of both classes all the time, and facilities for making the mix.

While there is plenty of fuel oil available on the other side of the line, the price is prohibitive down here on account of the Mexican duties. It is, therefore, easy to see why we began to look about for a method to increase the efficiency of the furnace and why we decided to try out the pulverized coal proposition in preference to the more expensive and awkward gas-producing system.

Initial Equipment

Our experiments began in the early part of September. We were equipped with only two pulverizing machines which, on account of motors deficient in power, prevented us from pulverizing more than approximately 35 tons of coal per day with both pulverizers in operation, whereas the manufacturers sold them (as well as the motors) to us with the understanding that each one of the machines would alone have this capacity.

When we first started up the machines we led the mixture of coal and air into the furnace through a 10-in. pipe from each machine directly through the wall back of the fire-box, at a point a little above a line on a level with the bridge, and spaced so that they divided the back end of the furnace into three parts; that is, the distance from one side wall to the center of the first feed nozzle was the same as from that point to the next feed nozzle center and from that point to the other side wall.

For the first few days the results were excellent. With the quality of coal we were getting at that time we were previously only maintaining an average of about 100 tons per day. The very first day it jumped up to 139 tons and then to 180, then down to 175 on a day when we expected it would pass the 200-ton mark; the next day it went down to about 130, and then we knew something was wrong. Investigation proved our draught to be gone because the flue leading from the furnace to the boilers had been accumulating a gummy ash on its walls and bottom until the area was so restricted that the gaseous products of combustion were not being carried from the furnace at a sufficient speed. The hearth was dead, and the coal ashes were piled up in the furnace, increasing smelting difficulties.

Prior to making this discovery we had noticed that coke was being deposited on top of the charge and forming an insulating blanket upon it. While we were cleaning out the flue we decided to change the shape of the nozzles from two 10-in. round ones (which were the most con-

venient for us to make at the start) to two nozzles each a scant 2 in. high and 50 in. long, covering a space over the back of the furnace of approximately 100 in. This has been efficient, so far, in preventing the formation of coke in the furnace, for the coke is not entirely due to a lack of air. With the nozzles of large diameter previously used, the combustion took place on the outside of the column of coal and air entering the furnace, and because of the speed the combustion would not reach the center of this column until a distance of from 10 to 15 ft. had been passed. Consequently, there was a continuous cone of coal dust and air for this distance from the entering point of the nozzles. This cone was, of course, subjected to the intense heat of the flame around it, and to this fact I attribute in part, at least, the formation of coke, an agglomeration and coking of the coal-dust particles (possibly formation of lamp-black and subsequent coking). With the improved nozzles we made a provision for the entrance of outside air drawn in through two 2x100-in. slots, one above and one below the nozzles. In this manner, by spreading out the flame, we have cut down the length of the dead center from 10 or 15 ft. to about 6 inches.

Necessary Modifications

After filling up the flue to the boilers with ashes and cleaning it out a few times, and realizing that we were getting no reasonable efficiency out of our boilers at all, we decided to build a small stack directly at the throat of the reverberatory. This stack is only 40 ft. high (above the roof) and of about 24 sq.ft. area. The hight proved sufficient for experimental purposes, considering that the function of the draft is only to carry off the gases and not to exert a pull on the grate; the effect of the draft is supplemented by the pressure of the blast entering at the other end of the furnace. With this condition of affairs we commenced to get fairly good results again, but for some time the charge holes in our furnaces had been getting into bad shape.

Another important observation that we had already made was that the furnace could be kept in better shape by means of what we have termed "continuous charging" in place of intermittent feed, the custom having always been to drop charges of about 15 tons each, covering the furnace for about 25 ft. from the bridge. Since it took anywhere from two to four hours to smelt one of these charges, ashes from the coal were deposited on top of the charge all this time and resulted in a very refractory silicious blanket of appreciable thickness on top of the charge. By changing this practice and dropping in charges of about 800 lb. at intervals of about three to four minutes, the layers of ashes deposited on top of the charges were rendered very thin and were sandwiched in correspondingly thin layers between the charges thus giving the iron ore in the flue dust a chance to produce its fluxing effect. In this manner the ashes were fluxed off easily and continuously. The continuous dropping of these charges also served to keep the bath of slag moving, thus preventing the formation of islands or crusts. This worked very satisfactorily as far as it went; but the continuous feeding wore out our charge holes to such an extent that we had to repair them about every two or three days. During repairs the furnace would, perforce, cool off and upon starting up again it would not be hot enough to take care of the deposit of ashes accumulated on the slag bath and around the throat of the furnace, choking off the draught with results similar to those first described.

Plans for the Future

This is as far as we have gone. We are convinced that when the furnace has been reconstructed to meet the required conditions, we shall get excellent results with this manner of firing; even with the coal that we use here, we expect to operate the furnace with less than one ton of coal to five tons of flue dust smelted, and consequently to obtain a far greater calorific efficiency of the fuel in the furnace than possible with the old method, and *ipso facto* less waste heat with which to generate steam.

The plan outlined under which to resume operations involves the following: The throat of the furnace will be enlarged to probably more than double the area of that which is used at Anaconda. The gases will pass into the small stack for the time being, and the draft will be controlled in the old-fashioned manner by means of a door in the side of the stack through which to allow cold air to enter until the speed of the gases is reduced to the desired point. On the center line of the top of the furnace six charge holes will be provided extending from near the bridge to a point about 60 ft. from it. We expect, however, to do the greater portion of the charging through the holes nearest the bridge. For these holes we have designed cast-iron pipes about two feet long having an internal opening 10 in. in diameter and with walls 3 in. thick in which will be cast a close spiral-pipe coil for water cooling. The bottom of these pipes will be flush with the inner surface of the roof and the tops will consequently project about 12 in. above. The tops of these pipes will be provided with sliding doors of fire-clay tile, or cast iron (possibly also with a pipe coil), and the general design so arranged that in dropping the flue dust from a point above by means of funnels through these charge holes, none will be allowed to spill upon the top of the furnace. (It is the fine iron ore in the flue dust that destroys the charge holes by slagging the silica brick.) The fire-box of the furnace will be cut off entirely, and a wall will be built up from the back of the bridge to the roof; through this the feed nozzles for the coal and air will enter. Another unit of the pulverizing machinery will also be provided. This third unit we do not expect to use except while one of the others is being repaired, which is not as frequent as anticipated. We have also ordered more powerful motors for these machines.

I think that we should also lower the roof of our furnace which now stands 6 ft. 6 in. above the bottom; but that would represent a considerable expense, for silica brick must be imported from Montana or Pennsylvania; besides the roof is in excellent condition, except at a point near the bridge where we have been having trouble with the charge holes. Another reason why we do not wish to go to the expense of changing this roof at present is our intention to remove the reverberatory operations to a more convenient site just as soon as we have come to definite conclusions in regard to the best methods to be adopted.

Waste-heat Boilers a Secondary Consideration

When conditions are worked up to the maximum efficiency the waste heat for steam generation will be reduced considerably, and by the use of steam boilers to utilize this waste heat, the ash difficulties are going to be increased accordingly.

Whether or not it will be economy to utilize the waste heat in steam boilers remains to be seen. I visited the reduction plant at Anaconda during the summer of 1905, and my recollection is that the large reverberatories there were treating about 275 tons of hot calcines per day with 70 tons of coal and generating about 600 boiler h.p. with the waste heat from the furnaces. Now, if this statement is correct, a little comparison of what we expect to do with the pulverizers will be of interest. Our coal in Cananea runs considerably higher in ash than the coal used in the Anaconda furnaces; but in spite of this difference we expect to smelt our flue dust with less than 20 per cent. or 55 tons as compared with 70 tons at Anaconda. The flue dust which we treat is hot as compared with this material as usually handled, but its temperature does not approach that of the hot calcines fed into the Anaconda furnaces; the high temperature of the calcines naturally reduces the amount of fuel required to bring them up to the smelting temperature. It is also probable that these calcines will make more matte than our flue dust because they are concentrates containing a higher percentage of copper, which also suggests an easier smelting mixture. These two points alone will probably offset the value of the coke that is recovered from the ashes from the Anaconda reverberatories. Suppose we allow only 2½ lb. of coal per horse-power hour to the Montana waste-heat boilers; this would be equivalent to 18 tons of coal per day,

which would bring the net coal consumption for smelting purposes down to a figure about equal to that of our furnace. Consequently an equivalent amount of coal, the heat from which is conserved in the Montana boilers, would be saved in the furnace at Cananea. It is my opinion that the advantages to be gained by attaching waste-heat boilers to coal-dust-fired reverberatory furnaces is a matter for future consideration in the development and refinement of the process, after the point of primary importance, the successful operation of the reverberatory itself, has been taken care of.

The pursuit of minor economies at the expense of major advantages is too prevalent in smelting plants. I have known engineers who proposed shutting down an entire plant for the purpose of patching up a small leak in a steam line, when the cost of shutting down would represent a far greater loss than the escape of the steam for an almost indefinite period. I have also had experience with men who wished to run the blowing machinery to suit the convenience of the power house and to the detriment of the furnaces, losing sight of the fact that a smelting plant is not operated to run the blowers but to smelt ore. When we satisfy ourselves that we thoroughly understand how to smelt flue dust or anything else in a reverberatory furnace with coal-dust firing, we shall be very glad to tackle the proposition of utilizing any waste heat generated; but until the first point has been taken care of, that is certainly a matter of only secondary importance.

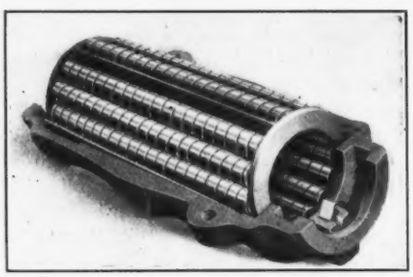
Shafting Friction

Many attempts have been made to improve upon the ordinary bearings for shafts. For light work, ball bearings are good but with heavy loads not only do the steel balls sometimes break but owing to the few points of contact the races become grooved and the balls wear irregularly. If large balls are used, then the bearing becomes expensive. The balls must be hardened and ground and require hardened casings which must be turned very true. Theoretically ball bearings are the best but for heavy work they are very unsatisfactory.

In order to obtain more points of contact, roller bearings have been used instead of ball bearings for heavy work. But, when the roller bearing is solid, difficulties arise in practice which limit their use. Theoretically the contact in these roller bearings is a line but in practice, owing to the bearings and shafts getting a little out of line, the contact, because of the rigidity of construction, becomes a point.

To obviate this the flexible roller bearing has been evolved in which the rollers are spiral springs which bend under pressure and so conform exactly to the shaft and come in contact with it throughout the entire length even when the shaft gets out of line. George W. Woodruffe in a lecture on "Roller Bearings" delivered before the Institute of Marine Engineers, Jan. 13, recommends such bearings for line shafting and similar work, but not for gas engines or for crank-shaft bearings, etc., on reciprocating engines.

The Hyatt roller bearing made by the Hyatt Roller Bearing Company, Newark, N. J., consists of a bearing case, inclosing flexible, spiral, cylindrical rollers that form the bearing surface on which the shaft rotates. Owing to the fact that, on account of their flexibility, the rollers come in contact with the shaft along their entire length, neither they nor the casing require special case-hardening as is necessary with solid roller bearings. These rollers rotate in a bath of oil and, owing to their construction, especially good distribution of the lubricant is obtained. This bearing is not new to the trade for it has already



HYATT ROLLER BEARING

been in use for several years at many plants.

These roller bearings can be used for other forms of shaft bearing, such as axle bearings on cars, for loose pulleys on high-speed shafting and for bearings in different forms of machinery.

Some recent tests, made in the locomotive shops of the Buffalo, Rochester & Pittsburg Railway at Dubois, Penn., where Hyatt roller bearings are used, are interesting when considered in the light of the following statement by the late R. H. Thurston: "The friction of shafting in mills varies with size and load, from 0.33 to 1.5 h.p. per 100-ft. length, averaging for the 'main line,' with good lubrication about one horse-power." At these shops the line-shafts are made of cold-rolled steel and are carried in Hyatt roller bearings. In these tests it was found that with one of the shafting, 170 ft. long 2½ in. diameter, making 158 r.p.m. and carried by 19 hangers, the power consumed in driving the shaft was 0.3 h.p. or only 0.177 h.p. per 100 ft. of shafting. To drive another shafting, 180 ft. long, 2½ in. diameter, making 155 r.p.m., and carried by 22 hangers, only 0.7 h.p. was necessary or 0.39 h.p. per 100 ft. of shafting. These results compare favorably with the figures given by Professor Thurston.

New Coalfield in British Columbia

SPECIAL CORRESPONDENCE

In December, 1906, the Nicola Valley Coal and Coke Company, Ltd., of Vancouver, B. C., commenced mining operations on its coal lands situated near Coutlee, Nicola valley. Within a year it was shipping from 150 to 200 tons of coal per day, having meanwhile driven headings in several seams, put in surface works, provided shipping facilities, and placed one mine on a regular producing basis, with a second that will shortly be similarly maintaining a steady output of coal. The total production to end of 1907 was about 11,000 tons, railway transportation facilities not having been available until too late in the year to admit of a larger quantity being sent out. Production will be increased to about 400 tons daily early in 1908.

Recently the Diamond Vale Coal and Iron Mines, Ltd., cut a 6-ft. seam at a depth of 70 ft. in the second shaft sunk on its property, also in Nicola valley. In the first shaft water became so troublesome that work there was abandoned. In the upper part of the seam encountered in the second shaft there is a thickness of about 40 in. of coal of excellent quality. Another seam is known to occur, about 120 ft. deeper than that lately cut, and the shaft is to be sunk to open this up as soon as practicable.

As the Nicola valley coalfield is connected by rail with Vancouver, distant about 230 miles, its development on a commercial basis is of much importance to that city, which has heretofore obtained its supplies of coal chiefly from the Vancouver island collieries with, during recent years, smaller quantities from the Bankhead colliery in western Alberta. The Canadian Pacific Railway will also take much coal from Nicola mines for its own use.

A New Railway in British Columbia

Consul L. Edwin Dudley, of Vancouver, reports that some American capitalists will commence the construction of a standard gage steam railway from Kamloops, British Columbia, to Salmon river, a distance of 40 miles, early this spring. On this line are the large beds of gypsum on the Salmon river. The plans include a $100,000 plant at Kamloops, where the gypsum will be manufactured into plaster of paris.

The Saline Deposits of Carmen Islands

By Edward H. Cook*

Carmen Island, in the Gulf of California, 100 miles south of Guaymas, is remarkable for its salt product and saline deposits at Salinas bay. The island is of volcanic origin and irregular outline. It is about 17 miles long northeast-southwest and 5½ miles wide in its northern portion, and situated in latitude 26 deg. north and longitude 111 deg. west.

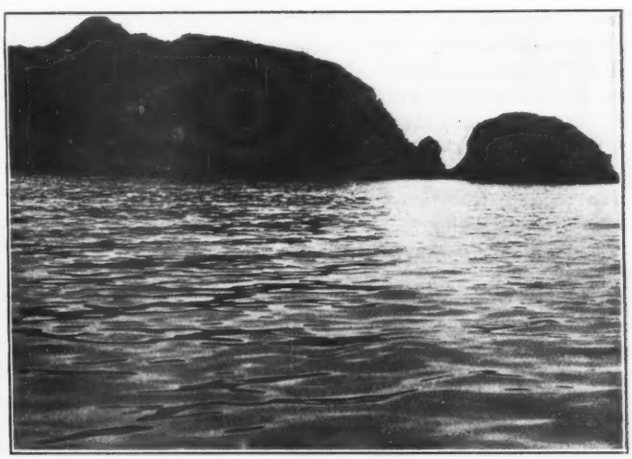
Its geology in general is a foundation core of andesitic and trap rocks, covered with sandstones, marls, clays and bodies of compact limestone, all much tilted and broken. The hills rise prominently from the sea and form a range of peaks of from 500 to 1,600 ft. elevation extending the entire length of the island. Fresh water is found at only two points and the scanty vegetation consists of native grasses and scrub plants of thorny varieties.

Near the south end of the island along a sandstone beach, asphaltum is found similar to that occurring five miles to the west on the mainland south of the village of Loreto. One or two surface contacts of sedimentary rocks with the eruptives show copper stains and indications, but prospecting has proved nothing of merit.

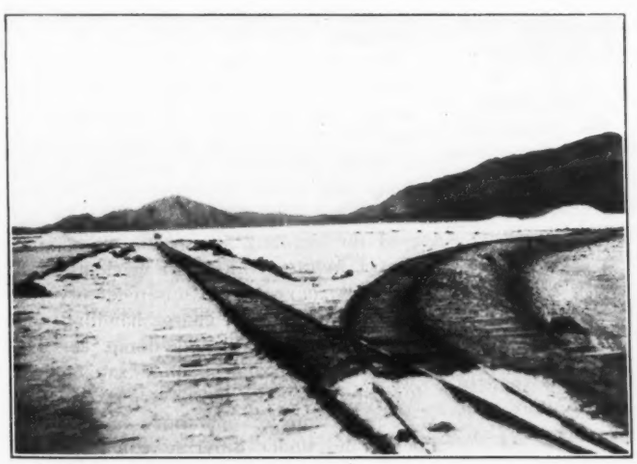
At the head of Salinas bay a curving strip of shingle beach, ¼ mile wide, divides the bay from the salt ponds which lie in a valley between high hills, comprising a tract of flat land one mile wide by two miles in length. At one time this was a part of the bay but some volcanic action elevated a ridge, represented now by the strip of beach, as a barrier to the passage of the gulf waters inland. This valley bottom is composed of muds, washed by the freshets from the hills, intermixed in horizontal layers with marine sands of unknown depth, heavily impregnated with salt. Drill holes 40 ft. deep have not reached bedrock.

These salt lands lie slightly below the high-water level of the bay, and it is hard to understand how sea water can enter passing through the mile of horizontal thickness of beach and sloping bay bottom. However, the production of salt is occasioned by springs fed from the bay, the water percolating through these beds and rising to the surface as ponds a few inches deep. Rainfall naturally increases the extent of the ponds, and the size and position of the wet portions of the flat shift from season to season, but seepage water can be developed within a few feet of the surface at almost any point.

GENERAL VIEW OF SALINAS BAY, SHOWING THE SHINGLE BEACH AND SALT PONDS



CAPE PERICO, SALINAS BAY



SALT PONDS, SALINAS BAY

VIEW OF THE BEACH AND SETTLEMENT FROM THE SALT PONDS, SALINAS BAY

Handling the Salt

The percolating brine brings the salt to the surface which at once begins to crystallize upon exposure to the sun and air. Nature is aided in more rapid crystallization by heaping small rows of new salt piles in the ponds. These serve as nuclei for aggregations which develop into large quantities within a few days. The product is loaded into carts and moved to storage stacks on the beach. The salt is wet and even after drying in the sun, contains much moisture, but is exceptionally clean and of high purity in sodium chloride.

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These saline deposits have been worked from the time of the entry of the Spaniards into Baja California. For years the Mexican government maintained a penal colony on the island and operated the deposits with convict labor, but during the French intervention the island was sold to private persons.

During the construction period of the Sonora Railway, officials of that road and the Santa Fe Railway system acquired the salt franchise under lease and spent a considerable sum of money in machinery and improvements, but their operations were abandoned during the early financial reverses of the railway companies and the property reverted to the owners. The plant installation has been neglected and a long wharf has been partially washed away, so that the present equipment is in bad condition. Transfers of cargo to and from ships are made by means of small lighters towed by canoes.

The production is now about 1200 tons monthly, but not over 200 acres of the total ground area are being worked, and the production is apparently only limited by the quantity of labor employed and transportation available. The cost of digging, stacking and handling to the vessels' side is about $1 (Mex.) per metric ton. Labor is scarce although cheap. The *peones* mainly come from neighboring coast fishing villages and are constantly changing, for the summer climate is exceedingly trying and the living conditions are bad.

The salt is marketed along the west coast ports and shipped to the interior by rail from Guaymas. Very little is sent out ground for table use, for the Mexican demand is for crude salt which is shipped in bulk on sailing vessels or sacked for rail freight.

Coal Lands in Oklahoma

A despatch from Guthrie, Oklahoma, says that the commission appointed last year by the constitutional convention to advise the first State Legislature as to the advisability of purchasing 440,000 acres of segregated coal and asphalt lands in the State recommends their purchase by the State at a price not exceeding $10,000,000. The commission recommends that the State issue bonds, subject to the vote of the people at the next general election, to the amount of $10,000,000 or as much thereof as necessary for the purchase at a reasonable price. The commission also recommends that members of Congress from Oklahoma be requested to urge upon Congress the enactment of a law which will permit the State to purchase these lands.

According to *Echo des Mines*, the exportation of asphalt from Trinidad was 205,874 metric tons in 1907 against 103,708 in 1906.

The Location of Smelting Works

By Redick R. Moore*

The article by Herbert Lang upon this subject which appeared in the Journal of March 23, 1907, seems to have elicited no replies. It seems to me that he has not given a fair and impartial statement of the advantages and disadvantages of the various classes of smelting sites.

If we define a level in a smelting plant as "a horizontal space upon which work is done," the simplest site will require five separate levels regardless of location: (1) Unloading, (2) storage, (3) charging, (4) furnace floor, (5) slag dump. Two or more of these may be upon the same horizontal plane, but the unloading level should generally be above the storage level.

The problem of plant location is to arrange these levels and the intermediate levels for roasters and sampling works in such a manner as to secure the most economical handling of the ores, fluxes, fuels, products and supplies, at the same time avoiding interruptions of the process as far as possible. On a single-plane location there must be a lift to the unloading level, a horizontal movement and fall to the storage level, a horizontal movement and lift to the charging level, a fall to the furnace floor level and a horizontal movement and lift to the slag-dump level—three lifts and three horizontal movements.

A three-terrace plan will require a horizontal movement to the storage bins, a horizontal movement to the charge floor, and a horizontal movement to the slag dump—no lifts and three horizontal movements. The horizontal movement to the slag dump will be much less in the terrace plan than in the level plan.

In the single-plane plan, I have assumed that the railroad company delivers to the smelter upon the smelter level requiring the use of gradients to get upon the trestles which are used practically universally for unloading. In the three-terrace plan I have assumed that the railroad company delivers at the unloading level, as any other arrangement would necessarily be due to other considerations which do not enter into the problem we are studying, such as costs of grounds, the smoke problem, etc., presuming that no one would commit the blunder of climbing a hill for a site if there were available places below.

The horizontal movements in either case are precisely equal if the same number of unloading tracks are employed and the storage capacity is the same, but in the three-terrace plan one trestle is replaced by excavations and a retaining wall, which may cost either more or less than the trestle, depending upon locality and conditions.

A two-terrace plan, assuming that the railroad company delivers at the storage level would, therefore, resolve itself into one lift and three horizontal movements; and a one-terrace plan into two lifts and three horizontal movements, amounting to a level plan with fall for a slag dump. While in a terrace plan the unloading tracks will naturally follow the contour of the hill, it does not follow that the plant need be laid out transversely to them, for most hills have shoulders or angles so that the tracks could be continued directly over the charge floor if that were desirable. But by laying them out transversely the horizontal haul from the storage bins to the furnaces is reduced very considerably. The terrace plan does not increase the gradients upon the unloading tracks, but decreases them as once upon the unloading level and having all switches upon firm ground on that level it is not necessary to come down to the level of delivery to switch to another unloading track, as is the case upon a level plan. The necessary gradients in a terrace plan are only to handle material between the various levels and to handle matte or bullion back to the railroad company, or unloading tracks. These are comparatively very small tonnages and from my own experience I greatly prefer gradients to elevators or hoists, both as to safety and economy of operation and first cost.

The equipment for handling ores, fluxes, fuels, matte for re-smelting bullion and returned slag should be entirely independent of the charging equipment as well as of the equipment for handling slag to dump and matte to converters. Steam locomotives with large pots should be used for handling slag to the dump, for electric motors, while more economical as to power, have proved unsatisfactory for several reasons. For charge handling, the electric motor with side-dump cars is highly efficient and is quite satisfactory for handling matte to converters.

Comparisons of operations in different fields and under differing conditions, if superficially made, are very likely to lead to erroneous suppositions. For example, the problems encountered in the location of an iron furnace 80 to 100 ft. high and producing up to 50 per cent. of its charge in metal, are widely different from those of a copper or lead furnace producing from 2 to 15 per cent. of the weight of its charge in bullion or matte.

There are also savings which in the end turn out to be false economy and one of the greatest of these is the "direct from the mine to the furnace" fallacy. While this plan may be possible in isolated cases, it generally results in tonnage losses, metal losses, extra fuel and irregular running, an aggregate of losses amounting to many times the saving.

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Reduction of Working Costs at the Rand Mines

Labor Is Inefficient, Consequently Expensive; Power Costs Could Be Reduced Materially by the Purchase of Electric Current

BY GEORGE A. DENNY*

The whole aim of the Rand administrations is now directed to the possibility of lowering the "works costs." The principal wastages on a mine are included in (1) labor, (2) stores, (3) power.

In the matter of labor it is generally admitted that the Rand is pre-eminent for waste and therefore for cost. The plain facts are: regarding the white labor, it is at once the highest paid and least efficient on any field; and regarding the black labor, that its cheapness is quite imaginary, when the average performance is taken into account. Competition has been an unknown element, and the price for skilled labor has gradually advanced —especially in some descriptions of work —inversely to the output. The recent strike marked the first genuine attack upon the labor monopoly stronghold, and, doubtless, the result will be to eventually secure for the mines an output from the skilled rock-driller in some measure proportionate to his earnings. But the most optimistic estimate in this direction cannot succeed in showing a saving of more than 1s. per ton of ore milled, and it may take a long period to effect even this.

The direction in which savings lie is not, however, in my opinion, so much in the cutting of rates, as in the reduction of the number of men engaged. The rates in general are not so high, when the living conditions of the country are taken into account, as to leave a great margin for cutting, consistent with the observance of a living wage, although, as has been lately shown in the case of a rock-driller, there are certain sections of the workmen who have been earning inordinate pay.

In making a proposal to reduce the number of white workmen, I take into account the conditions under which mining operations are conducted in other parts of the world, and the number of men employed. It is safe to estimate that the Rand employs, on a per-ton-milled basis, from 10 to 20 per cent. more white men than do the West Australian mines, and in addition to the excess of white labor there is the excess of the entire force of colored laborers employed. A low proportion of colored laborers on surface work would be one for every two tons of ore crushed per day, and an average proportion of white men would be one man at surface for every five tons of ore crushed. In West Australia the average number of men employed on surface on the Ivanhoe mine, which has a metallurgical treatment somewhat similar to that on the Rand, is about one man for every six tons crushed per day. Assuming a basis of 500 tons crushed per day, the Rand would employ 100 white men and 250 colored laborers, as compared to, say, 85 white men all told in West Australia. Such comparisons might be made with American practice with about similar results.

Comparisons between the underground employees at the Rand and elsewhere will show equally badly for the former; but such comparisons are not necessarily allowable in mining work, because the conditions differ so much in every locality. It may be stated, however, that the cost of white supervision in almost all underground operations on the Rand shows a cost out of all proportion to the relative number of white and colored laborers employed. This is well exemplified in rock-drilling operations, in which a white man employing three natives may earn an average of £50 per month, whilst the natives who do all the rough labor will collectively earn £9 per month. The complaint, however, is not that the white man earns £50 per month, but that if he were willing and competent, he might supervise five or more gangs of natives earning collectively £45 and upward per month. The relative cost of supervision would then be greatly decreased. Assuming a case of a mine which is paying 50 rock-drill stopers at the rate of £40 per month each, and mining an average of 450 tons per man per month, when supervising two rock-drills the cost per ton for white labor would be 1s. 9d. If the supervision were extended, so that each miner took four drills only, the cost to the mine, assuming the same rate of earning as before, would drop to 10d. per ton for white labor, or a saving of about 1s. per ton of ore broken. The reduction in numbers among the workmen would create a situation never yet experienced on the Rand—viz., competition for employment by experienced men. The competition would of itself raise the standard of efficiency, and that not only in the work done, but in the consumption of stores used in its performance, and in the maintenance of machinery; thus effecting further important savings.

Economy in personnel need not, however, be confined to rock-drilling. There are other departments in which this can be effected without interfering with the general output, notably in the reduction processes. As at present organized, there are too many heads in the mill and cyanide works. Mill managers and mill foremen, cyanide managers, and cyanide foremen are found on almost every mine. They are for the most part unnecessary. One qualified manager or foreman of the reduction processes is all that the exigencies of the situation demand, provided that the subordinates are competent for the routine work. In this direction the average man has in my experience left a great deal to be desired, and an innovation such as is suggested could only gradually be accomplished. The substance of these statements is, in short, that the surface departments are overstaffed, as well as overmanned, and that useful economies lie in the direction of organizing upon a simpler basis.

Cost of Government Regulation

The demands of the Government and the head offices of the mines cause appreciable cost to the companies. The Government requires statistics upon every conceivable subject, at the expense of the mines, necessitating the employment of hundreds of extra clerks and surveyors, taking the mines as a whole. There is probably no mining field in which the Government demands in this respect are so costly, nor is there any field on which such a mass of figures is compiled for the "use" of the head office. When I say "use" of the head office I hardly convey the correct meaning, because the figures are to all intents and purposes guesses of the management upon distributions of yield and cost per ton, and are therefore of no genuine "use." The laborious account systems which are in vogue are, in almost all essentials, a perfect waste of money, because they purport to reflect to several places of decimals the various items of expenditure, when as a matter of fact the original lump sums into which the total expenditure is divided for further analysis are arbitrarily guessed. Appreciable reduction could be effected in the clerical staff, in stationery, printing, if a simple and not over-ambitious accounting system were substituted for the existing complicated maze of guesses, and if the Government were to suspend about nine-tenths of their regulations—that nine-tenths, to wit, which is quite unexampled on any other field. It is, of course, useless for one manager or for one small group of mines to attempt to introduce sweeping alterations. If attempted with-

Note—From a pamphlet reprinted from the London *Mining Journal*.

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out the general co-operation of the companies it is foredoomed to failure. Discontented and unwilling men are a menace to any industry, and I have realized for years past that no effective measures of economy could be practised until the leading groups were convinced of their necessity. As soon as they are convinced, and give effect to their convictions, the smaller groups may safely follow; until that time, as they are the chief employers, they set the standards which the smaller groups must accept, or be saddled with the cream of the incompetents, inefficients, and discontented, thus convertng apparent economies into still greater losses.

Economies in the matter of colored labor are simple to state but difficult to effect. The number of black laborers at present employed on the mines should be ample, if effectively handled, for the requirements of the whole industry, and the Chinese or other aliens should be quite unnecessary. The black laborer is, however, extremely inefficient, because: (a) He knows no moral code sufficiently powerful to compel him to his best efforts on behalf of his employer; (b) He is not forced to compete for employment, but, on the contrary, is competed for by employers; (c) He is not supervised by white men of high average efficiency, nor of high average regard for duty; (d) The natural conditions in which he is reared tend to the propagation of idle habits, and the "dignity" of labor is never an element of his youthful instruction.

The inevitable result of all these features is that the native laborer seldom learns to work with that continuity of effort which prevails among efficient white workmen. He has been largely employed on the mine at piece work, and at such a rate of pay that a fraction of a day's work has been sufficient to give him the money requirements for his moderate needs. Figured at the rate per hour, however, his cost when working as a miner, including the cost of food, etc., approximates to the earnings of the efficient European in other parts of the world. His monthly earning is small, because he works only as a miner for about 80 hours per month, or, say, 10 complete days of eight hours, while the white miner elsewhere works at least 208 hours per month for 26 days. If the native were to work 26 days of eight hours per month at the same rate per hour as he now earns, plus food, etc., his earnings would practically equal that of a skilled white miner elsewhere.

When we say that the native is a cheap laborer we shut our eyes to the fact that he works about one-third of the average time only; and if we consider that two extra gangs are required to fill up the remaining two-thirds of the working time, we discover that we have to treble the wages of each individual to represent one day's continuous work, and, incidentally, have to feed and house and pay all other costs on three individuals, where one would suffice. The ordinary practice, therefore, with regard to the native laborer eliminates the whole idea of cheapness, and proves that the native is in reality a very expensive workman, without considering the additional cost of the white supervisors.

To improve his efficiency is apparently simple—viz., to make him do a fair day's work. But the circumstances of his work and surroundings must be considered. He has behind him his natural indolence, and the experience of so-called "work," since the inception of the white man's dominance in the country. He is a creature of habit and ultra conservative in his methods. He has been employed to work as a miner, on the understanding that the drilling of one 30-in. hole—nominally 36-in.—represents a day's work, and to alter the basis at this late day, to a demand for two holes of 30-in., would entail time and patience, and the constant example of strenuous effort on the part of his supervisor to effect. But it can be done. It has not been done in the past, because the old political bogey of arousing the white man's opposition, if he were paid by results and not by artificial standards, has always operated to prevent the attainment of efficiency, where it must first be secured. With the passing of that bogey there is not the least reason why gradual and important improvements should not be effected in the efficiency of the native laborers, to the extent of securing eventually three times the present output of work, with great economy in cost, and a reduction of two-thirds in the number of laborers required.

The number of natives employed in surface work on the mines is susceptible of at least two-thirds reduction, if the white men employed were to conform to the standard set by the Westralian men, which brings us back again to the original starting point—viz., the efficiency of the white man. Firstly, and always, let that be insisted upon, and the dependent questions, including the cost of stores, and the savings possible in that direction, will fall into line with remarkable results in the cost of production. The total economies in working costs which have been realized during the last 10 years amount to, approximately, 2s. 6d. per ton of ore milled, of which fuel and explosives are answerable for about 2s. per ton, the balance of 6d. per ton being the savings on every other head, including labor. During the same period the grade of ore mined has fallen over 10s. per ton.

Power Cost

This item of the working charges never appears in the usual statement of costs as an independent item, for the reason that it enters into the various other heads, into which costs are subdivided. It is, perhaps, the most difficult of all expenditure to allocate satisfactorily, and as it forms an appreciable proportion of the works cost—viz., about 3s. 6d. per ton of ore milled, equal to about 15 per cent. of the whole, errors made in its distribution have a serious effect in departmental costs.

The reason why power cost is difficult to distribute is not far to seek. The power plants on mines consist of machinery of almost every possible degree of efficiency, ranging between 5 per cent. and 85 per cent., and any given portion of the plant, even if capable of working at high efficiency at full load may drop seriously at underloads, so that for every section of the plant there are constantly varying economies to be considered, which in practice cannot be accurately determined. As an illustration of the effect of varying loads upon engines, the following statement may be made, taking a 100-h.p. engine, having 85 h.p. available for work at the driving wheel:—At full load we obtain 85 h.p. available for work, or 85 per cent. efficiency; at half load, 35 h.p. available for work, or 70 per cent. efficiency; at quarter load, 10 h.p. available for work, or 40 per cent. efficiency.

If 1 h.p. costs £20 per annum at full load, it will cost £28 6s. at half load and £50 at quarter load. Here we assume the costs of generating to be the same at the lowest output as at the higher, when in practice that would not be the case, so that the differences would be even greater than are shown.

The method by which the distributions are made is one entirely of guess. The average indicated horse-power of the main engines is used as a basis, and from this the distribution of power to each department of consumption is arbitrarily made upon the judgment of the manager, and it may be safely said that no two independent sets of men would make anything like the same distribution of costs to the various departments, on the data available on the average mine. The system universally employed rates all indicated horse-power as of equal efficiency and cost, and therefore the mill engine, which certainly runs at the highest efficiency, is rated at the same standard per indicated horse-power as a wasteful air-driven pump placed in an out-of-the-way corner of the mine. The relative efficiency in the two instances is about in the ratio of 10 and 85—the mill engine gives 85 h.p. out of every 100 generated, available for work outside the engine, while the pump has only 10 h.p., or less, available for work for every 100 h.p. originally generated by the air compressing engine.

No notice whatsoever is taken in the accounts of the horse-power used up in the condensing systems in the feed pumps, small auxiliary plant, or that dissipated from blowing down boilers, steam traps, etc.

These are all lumped into the general charges on power account, and their existence is not even mentioned. It has

been found by test that some of the condensing systems have absorbed as high as 20 per cent. of the total power of the main plant, giving in return a theoretical 10 per cent. increase of power. The actual steam consumption per indicated horse-power developed by the condensing and auxiliary plant may safely be taken at two to three times that required for the main engines; in other words, each indicated horse-power costs three times as much for fuel, and, proportionately, for the allied charges. The aggregate power absorbed in condensing an auxiliary plant on the Rand cannot be less than the equivalent of from 20,000 to 30,000 h.p. when rated at the same efficiency as the main plant. The mine accounts are made up absolutely irrespective of this enormous power aggregation, that is, in so far as any recognition of its cost to the various departments is concerned. The question whether condensing as practiced on the Rand is not an absolute waste, and no economy at all, is one which might well be raised. I am convinced that the result would, in a great many cases, create consternation—firstly, because of the cost; secondly, because of the inefficiency of the engines operating the condensing plant; thirdly, because of the cost of water; finally, because the back pressure, owing to the altitude, is 2½ lb. per sq. in. less than at sea level, thus reducing the margin of effectiveness by 18 per cent.

The proportion of cost, therefore, as distributed saddles the efficient plant with the cost of the inefficient, and relieves the latter of charges which legitimately belong to it. Thus the departmental costs are grossly inaccurate with respect to the cost of the power consumed in the given processes, and as the mill engine and its driven plant work at the highest efficiency, and the highest average load factor, and at the same time generate a high percentage of the total power, this department suffers more than any other from charges which should, in a correct allocation, be borne elsewhere. Conversely, the mining department—including development—employs the most inefficient and costly portions of the plant—viz., winding and air-compressing machinery, and is relieved of amounts actually expended upon it, by debiting elsewhere.

The Rand industry has spent on power plant not less than £10,000,000, and on our stipulated basis for interest and redemption over a 10 years' life, the annual amount required for the service of this investment is £1,672,000. It is estimated that the Rand has in all some 255,000 h.p. installed, of which total I calculate that not more than 140,000 h.p. are constantly in operation. Of the 140,000 h.p. constantly in operation, however, there are actually secured for the purposes of work probably not more than 70,000 h.p. effective. The annual amount to be set aside for interest and redemption on the amounts sunk in power plant we have seen to be £1,672,000. If into this sum the effective horse-power obtained—viz., 70,000, be divided, it will be found that the annual amount per effective horse-power equals £24 nearly. Taking the charge as upon the tons milled, we may estimate that for 1907 the whole of the mines will have crushed a total approximating 15,000,000 tons of ore, or the equivalent of 4s. 6d. per ton of ore milled. To this sum must be added the average charge included in the working cost—viz., 3s. 6d. per ton, or 7s. per ton, when power is generated at 50 per cent. efficiency, bringing the total cost per efficient horse-power, including all charges, up to the enormous total of 11s. 6d. per ton of ore milled.

The mines of the Rand present many features inimical to cheap power production, viz.: (1) The necessity for the provision of superabundant power, in order to take care of the maximum load at any time demanded, inducing thereby high initial capital outlay and subsequent working of the plants greatly underloaded; (2) Generation of power in small stations by innumerable consumers, each of which requires a complete staff of skilled overseers out of all proportion to the output; (3) Every possible variety of electrical systems generating plants, pressures, and distribution arrangements, requiring that many and diverse spare parts be on hand, even on individual mines; (4) A bad load factor on all but the milling plant; (5) Excessive duplication of plant on neighboring mines, and, in fact, on every mine.

The mill engine plant is the most efficient power plant in the whole scheme of the mines. It has practically a direct drive, so that the losses in transmission are greatly minimized, and the load on the engine may be regarded as constant throughout the year. The engine itself may conceivably have an efficiency of 90 per cent., and the transmission losses from thence to the mill line shaft are such that the average efficiency of the power at the mill line shaft pulleys may be stated at 78.5 per cent., which is by far the highest efficiency obtained on the mines.

Inefficiency of Air-Compressing System

The air-compressing plant forms a large proportion of the total power generated, and the losses due to its use are such as to preclude it from being considered in any sense efficient. The air-compressing machine itself is, of course, exempt from this statement, as we are dealing with the whole air-compressing system in use on the mine. An efficiency of over 70 per cent. might be secured from a well-designed air-compressing engine, compressing the air in two stages, with inter-cooling arrangements; but it is doubtful whether a higher percentage than this could be maintained, even under test conditions, because of the losses which are difficult, if not impossible, to dispose of, these covering such items as valve leakage, cylinder clearance, frictional losses, temperature increase, etc. In mining practice, nothing like 70 per cent. efficiency can be averaged, even in the engine itself, because of the work it is called upon to do. It operates for not more than 18 hours out of 24 on full working days, for fewer hours on Saturdays, and frequently not at all on Sundays. During the working shifts it is run only at full load for the first few hours, after which, at intervals, the rock drills finish their day's work at various points in the mine, and so lessen the demand on the compressor. In between shifts it is either run dead slow, merely for purposes of ventilation, or for pumping, or not at all. It has, therefore, everything against the attainment of a maximum degree of efficiency. The next losses accrue in the friction in the air mains, and leakages and waste therefrom. Each mine on the Rand is reticulated with an air system, in which the diameter of the pipes varies between 10 in. and 1 in. The whole system may consist of many miles of piping, and it has happened, on test, that the leakages have been so bad as to require 30 revolutions per minute or more, of the engine to maintain the mains at working pressure. The losses in the pipe system from friction alone must amount to an immense figure in money.

Wastage of air is a further common form of loss. Miners, after blasting, utilize compressed air for ventilation without the slightest judgment in this regard. Valves are left full open in all parts of the mines, compelling the running of the compressor and the dissipation of energy to a great extent for no useful purpose.

The final losses, apart from that due to loss in temperature, are to be traced to the small air hoists, air pumps, and rock drills. An investigation into this matter would undoubtedly show that there are times when a 500-h.p. compressor is kept running over the week-end to maintain an air supply for one small pump, utilized in keeping clear a wet winze in some part of the mine. Tests conducted by myself on air pumps placed underground show an efficiency of under 10 per cent. Similar tests, taking the engine efficiency of the rock-drill into account, showed a result of only 6 per cent. of the power generated by the air-compressing engine, available at the rock-drill bit. This alarming loss of power has been confirmed by systematic testing conducted by a well-known engineer on the Rand,[1] and the general inference is that for every rock-drill running continuously in the mine at least 30 h.p. must be generated by the air-compressor. It must, of course, be remembered, that the aver-

[1]K. Schweder, mechanical engineer, in the employment of Goerz & Company.

age rock-drill does not actually bore more than about one-third of the time, so that in the ordinary way a provision of 10 h. p. for every drill working in the mine should be ample.

The bearing of these immense losses in the transmission of power by compressed air can be simply illustrated. If 1 h.p. on the original air-compressing engine costs £20 per annum to generate, the effective horse-power at 6 per cent. efficiency costs £333 per annum, all of which loss has to be accounted for in the working costs of the mine, no matter how disguised.

Economy of Electric Power.

So far, the general practice on the mine has been to install electrical energy machines for subsidiary processes and for lighting. The main electrical load, in the daytime, is given by equipment which runs in connection with the mill, such as breaking, conveying, and sorting. These processes are all at a standstill during the night, and excepting in a few instances, there are no steady 24-hour loads. At some portion of the day, therefore, the electrical plant is called upon to handle what may be considerably in excess of double its average load. In tests conducted by myself, the results show that the efficiency of the average electrical plant does not exceed 50 per cent., and is probably less.

The last division of power is represented by the winding engines, the efficiency of which is a function largely of continuous running combined with length of haul. An engine which runs very intermittently on short hauls must be inefficient, as there are enormous condensation losses in the engine itself, and the periods of load acceleration form a preponderating percentage of the run. The usual winding operations at the Rand are very intermittent, because the mines are invariably worked through two or more shafts, up to as many as five. At every shaft capital outlay is necessary for equipment, and working expenses are incurred not only in the standing charges, but for supervision, labor, stores, etc., which would require little or no increase if the hoisting engines were working full time. Continuous testing of some engines which I conducted showed that it required 12 lb. of coal to generate one continuous effective horse-power, and, approximately, it was found that for each pound of coal burnt 25 tons of ore were raised 1 ft. high.

Attention may now be turned to the remedies which may be applied to lessen the cost of power. In the mill engine plant, there is not, apart from saving in fuel consumption, very great margin for economy, excepting by the adoption of electrical driving.

The system of large central air-compressing plant is, to my mind, wrong in principle, because the transmission of air over long distances, and through the complicated system of mains of varying capacities, under no sort of control, necessarily results in heavy loss. The method of working compressed-air machinery in the mines and the necessities of the actual situation frequently demand that the big central plant should be run in order to furnish a minimum amount of air.

I have advocated for some years past the decentralization of the air-compressing stations, and that electrically-driven compressors, not exceeding a capacity of 500 cu. ft. of free air per minute, be placed at various points in the mine, in order that practically the whole of the transmission from the point of power generation to the point of use should be electrical rather than air, leaving only an inappreciable length of connections between the compressor and the drill. I estimate that the substitution of small air-compressing units would increase the general efficiency of the air system from 6 per cent. to at least 30 per cent. and a corresponding reduction cost from £333 to £66 per effective horse-power per annum at the rock drill bit.

The allocation of power for a 100-stamp mine on the Rand could be, approximately, estimated as follows: Mill, 317 h.p., or 32 per cent. of the total; electrical, 302 h.p., or 31 per cent. of the total; air-compressing, 288 h.p., or 29 per cent. of the total; winders, 62 h.p. or 7 per cent. of the total.

Calculating the above figures in terms of effective continuous horse-power, we have the following figures for the total effective horse-power available: Mill, 250 h.p., or 50 per cent.; electrical, 153 h.p., or 31 per cent.; air-compressing, 17 h.p., or 3 per cent.; winders, 62 h.p., or 13 per cent. of the total.

A comparison of the "effective" with the "generated" horse-power will disclose the remarkable transmutation in the percentages under each heading, illustrated most noticeably in the case of the air-compressing figures, which fall from 29 per cent. of the total horse-power generated to 3 per cent. of the "effective" horse-power available. The winding engine power is in each case taken on the basis of effective horse-power.

The figures from which the above comparisons are made were obtained in a series of tests which I conducted for that purpose, and on three mines very differently equipped, but presenting on the average a very fair mean of Rand practice. Carrying the figures still further, I found that the average interest and redemption cost per effective horse-power per annum amounted to £37.7, while the running cost amounted to £58.5 per effective horse-power per annum—a total of £96.2 per effective horse-power, exclusive of the winding engines. The cost of winding per effective horse-power I found to be the inclusive figure of £120 per effective horse-power per annum. These are, doubtless, new and startling figures, but I claim that they represent fairly accurate costs for Rand power. The item of interest and redemption charges is based on 8 per cent. interest and 3 per cent. redemption on the actual estimated "lives" of the mines considered.

Remedy for Low Efficiency and High Cost

We arrive now at the point in which it is necessary to consider how these alarmingly low efficiencies and high costs may be improved upon. In a word, the remedy lies in the adoption of a system by which the mines would not outlay any money in generating plant, but would purchase from an outside public supply. The relative efficiencies of the existing scheme and a purchased power scheme would be, approximately, as follows:

ECONOMY OF PURCHASED POWER.

	Present Scheme.		Outside Supply.	
	Horse-power Generated.	Horse-power Utilized.	Horse-power Generated.	Horse-power Utilized.
Mill plant.....	377	250	300	250
Air-compressing plant....	288	17	57	17
Electrical generat'g plant	302	153	204	153
Winding plant.....	100	62	83	62
	1,007	482	644	482

The respective totals show that the mines require to generate under the existing scheme, 1007 h.p. to obtain 482 effective h.p., whereas if a public supply were available they could purchase 644 h.p. and obtain therefrom 482 effective h.p.

If the public supply company's power were to cost an average of even £25 per h.p. per annum delivered to the company's switchboard, the cost would be (allowing £4 nearly for interest and redemption per horse-power per annum on the electrical installation), say, £19,000 per annum, made up of interest and redemption, £2,500, and the purchase of 644 h.p. at £25 per annum.

On the same principle, the cost under the existing scheme is, in round figures, 1000 h.p. generated, at £46.5 per annum, or £46,500. The purchase of power from an outside source shows a saving upon the comparison of £27,500 per annum, and even assuming the figures to be too favorable to the electrical scheme, there is a large margin left on the profit side, after making all allowances.

There is little doubt that if all mines would arrange for the immediate purchase of electric power they would save not less than 30 per cent. of the total power generated, because of the higher efficiency at which the purchased power would be utilized, and as the cost per effective horse-power would be considerably lower, when interest and redemption on capital outlay are considered, there could not fail to be a fine showing for the case of scrapping the existing plant.

Shaft Timbering Brakpan, Transvaal, S. A.

An Approximate Method of Framing These Timbers Is Used Because Side Pressure and Fast Hoisting Soon Displace Them

BY EUSTACE M. WESTON*

The timber used in the shafts of the Rand Collieries, Ltd. (Gold Section), is stringybark from Tasmania. Its grain is very straight and, when seasoned, this wood is hard; nevertheless it is almost as easily worked as pitch pine. Its weight per cu. ft. is 41 lb.; its tensile strength is 20,000 lb. per lb. in.; compressive strength along grain, 6000 lb. per sq.in.; modulus of rupture, 13,000; modulus of elasticity, 2,353,000; shearing strength, 1940 lb. per sq. in. It is, as can be seen, a timber much superior to pitch pine, which weighs about 50 lb. per cu. ft. and of which the tensile strength is 8,000 lb., compression strength 6000 lb., modulus of rupture 9,000 and modulus of elasticity 1,200,000. Besides, it resists decay better than pitch pine.

Consequently stringybark is rapidly coming into favor as timber for deep shafts here on the Witwatersrand, where really good pitch pine is becoming difficult to obtain. It is also much stronger than the West Australian timber, jarrah and karri.

The framing of the shaft timbers is shown in Fig. 1. With wages for carpenters at £1 per day and natives at 2s. per day the contract price for laying out and framing a shaft set is 25s. or $6.

Method of Framing Shaft Timbers

In "Mine Timbering" Wilbur E. Sanders describes a method for laying out the necessary tenons, mortices and gains that go to make up a shaft set. At this mine a very different method is employed; this method is perhaps not so mathematically correct, yet it saves a great amount of time and expense. In combination with the method of plumbing the shaft used, it is sufficiently accurate for any ordinary conditions.

Everything is laid out by templates. The truest face of the timber is selected as the inside face and the piece is turned so that any bend or warp will point upward. In framing a wall plate two templates, a separate one for each half-length of the wall plate, are used; these are cut out of thin wood or metal, having the total half-length, the length of half-check for end plate, the miter check and the face for divider checks laid off on them. These pieces, being flexible and in halves as regards the length of the wall plate, accommodate themselves to the face of the top of the wall plate and, when the wall plate is straightened out by blocking in the shaft, the error in total length and in the divisions is negligible. The centers for the hanging bolts are also marked with a brad-awl through this template. The details of the end framing of the wall plate are shown in Fig. 2. The small gain, ½-in. deep, on the top is used to give the 7x7-in. corner studdles a bearing an inch wide on the solid plate; consequently the outer side of the corner studdle does not come flush with the end of the wall plate. To mark off this end for cutting, template *A* is placed over the end of the uncut timber and four inches, the depth of the first cut, is marked on the timber. Template *C* is used to give the distance from the top of the halved tenon to the bottom of the gain for the studdle. The depth of these gains varies as the timber is over or under exact size. Template *B* is used to give the correct depth of the half-tenon after the top cut is taken out. The gain on the bottom also varies in depth with the size of the timber.

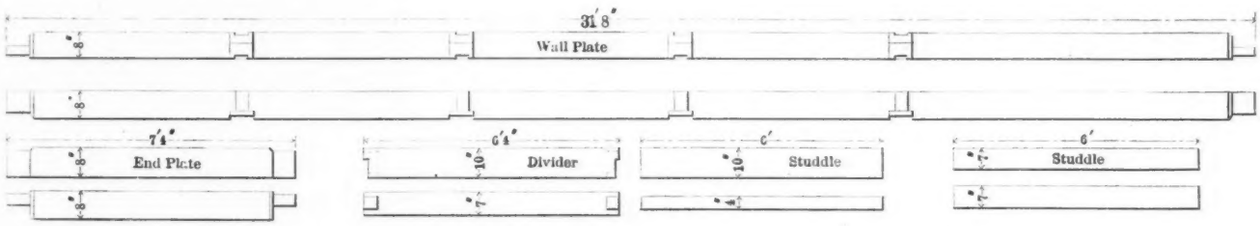

FIG. 1. DETAILS OF TIMBERS COMPOSING A SHAFT SET AT THE GOLD MINES OF RAND COLLIERIES, LTD.

Method of Framing the Divider Joint

The details of the divider joint are given in Fig. 3. The form of this has been criticised as weakening the timber and also as being too complicated, but it has certain advantages. At the Brakpan mines a simpler framing is used; the gain is made plain with the usual bevel and no gain is taken out of the top of the divider. At that mine in good ground the sets in the shafts are placed with 7 ft. 6 in. centers.

Template *D* is used to give the width of cut down the inside face of the wall plate. The depth of gain, ¾ in., is marked by an ordinary gage as is also the depth of top gain for the studdle. These are taken out after the width of the gain, 4 in., is marked off on the top of the wall plate by template *G*. Then the correct distance, 7 in., between the top and bottom gain is marked by aid of template *F*, which is also used to square off the two faces. The width and depth of the top recess of the gain is given by the use of template *E*. All the other joints are marked off in a similar manner.

The Placing of Bearer Timbers

A set of timber as shown weighs about 4778 lb. and contains about 67.3 cu. ft. The timber costs about $1 per cu. ft. at the mine, while pitch pine of best quality costs very little less. The cross-sectional area of the studdles is ample to bear the weight of about 600 sets. The 1⅛-in hanger bolts, six to each set, are left in the shaft for greater security. As far as weight alone is concerned three 7x14-in. stringybark bearers, having a 10-ft. span and 6-in. bearing surface in the hitches, would support without bending or crushing the weight of more than 200 ft. of timbers.

Bearers are, however, necessary to fulfil other requirements. They may have to support the timbers in case of a skip's leaving the guides or to take side or down pressure in heavy ground. Some difference of opinion exists as to whether it is better to put bearers in singly or in pairs at irregular intervals, or to place a complete set of bearers at regular intervals. Each method has its advantages.

In the first case it is possible to pick the best natural place for the bearer hitches and thus to reduce the labor in cutting them. Bearers are best laid in hitches on sacks of quick-setting cement. At this mine about five bearing pieces are placed in a distance of 100 ft.; these are

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placed in pairs or singly. Sometimes, however, four are placed together.

The shaft is not kept truly vertical by a straight edge with plumb line, so brackets of iron are fixed at the surface 12 in. from the corners and every 100 ft. the sets are checked by lowering wires with weights steadied in water. The intermediate sets are blocked to cord lines hung from small 3-in. corner brackets of timber from the sets above. About every 500 ft. another set of permanent iron brackets are put in and used for checking. As these are always laid off from the top, no errors, large enough to give trouble, can accumulate. The inside face of each wall plate is carefully blocked in a position parallel to a line stretched between the plumb lines.

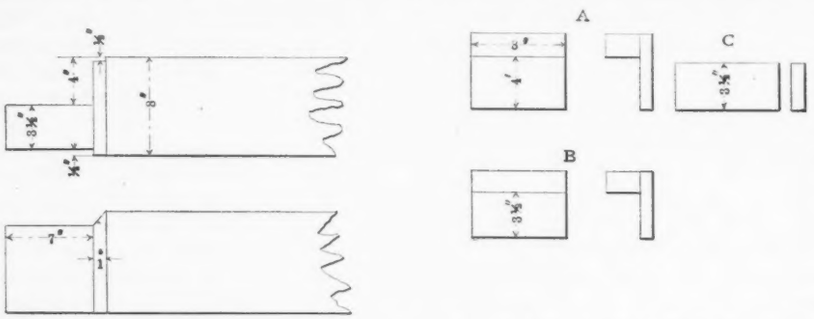

FIG. 2. DETAILS OF WALL-PLATE TENON WITH TEMPLATES USED IN FRAMING IT

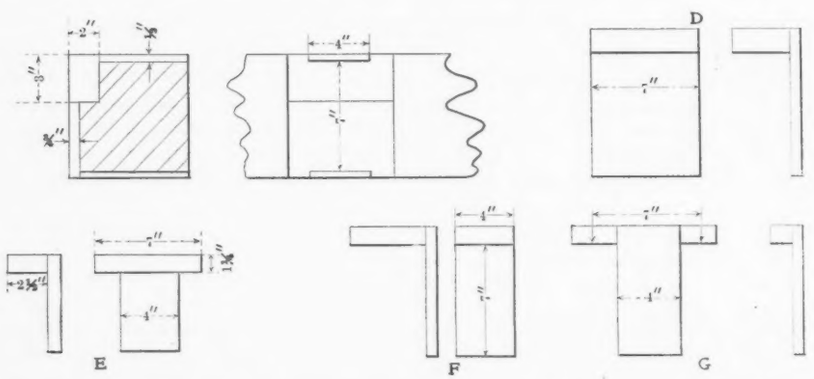

FIG. 3. DETAILS OF DIVIDER JOINT OF WALL PLATE, WITH TEMPLATES USED IN FRAMING IT

The position of the guides is always measured from the inside face of the wall plate. These guides are made of 4x8 in. pitch pine. At the Brakpan shafts the guides are made of special slotted steel having a double-Z section. At the Van Ryn Deep and the Kleinfontein Deep mines all-steel construction is used to support the walls of the shafts that are being sunk.

Timber Breakage

Recently a government mining regulation was passed making it compulsory to keep timbering within 50 ft. of the bottom. Before then, when sinking was rapid, the timbers were often allowed to get 100 ft. or more away from the bottom. This increased the liability of accident with the bucket and made it difficult to examine the walls of the shaft. Where the ground is hard, whether machine or hand drilling is used, ⅛-in. or ¼-in. plates are kept strapped to the bottom of the last three sets so as to protect them from the blasts. In ordinary ground, where timbers are not less than 40 ft. from the bottom, very little damage is done to the timbers even in sinking with air drills. Where the ground is so full of dangerous slips, as was the upper and lower portions of the diabase sheets in the shaft of the Rand Collieries, Ltd. (Gold Section) that the timbers have to be kept within a few feet of the bottom, it is impossible when the ground is hard to avoid breakages. At this shaft when the timber was about 25 ft. away from the bottom, the more numerous blasts from hand sinking were as destructive as the fewer and larger blasts used in machine drilling. Fortunately such a combination of ground is not often met in shaft sinking.

The richest part of the Rand, South Africa, is about 4 miles long by 1½ miles wide. This is bounded by the Pearl Central on the west, the Wolhuter on the east, the city of Johannesburg on the north, and the deeper levels of the South Deeps, Ltd., on the south. In this area are at present 14 mines paying dividends, including the Robinson, Ferreira, Crown Reef, Village Main Reef, Langlaagte Estate, City & Suburban and the "deeps" of these different mines. According to *South African Mines,* the total of the dividends paid to date by these mines is £24,808,350.

Caucasian Manganese Ore

Manganese ore from southeastern Russia has lately shown a decrease in output, resulting in advanced prices. The center of the industry is at Tschiatura, to which town the ores travel from the mines around Shorapan, a distance of 30 miles, over a narrow-gage railroad. At Tschiatura the ore has to be unloaded and then reloaded into regular trains for Poti, the export town, from which about 25,000,000 poods of manganese ore are shipped annually. The export business is wholly in the hands of foreigners. Russia consumes only about 5,000,000 poods per year.

There is a prevailing shortage of rolling stock on the railroads, so that a system of taking turns has to be enforced. No shipper, moreover, can secure cars unless he has at least 20,000 poods of ore on hand at Tschiatura, and the larger the stock a shipper has, the greater is the number of cars awaiting his orders. A speculator will sometimes vacate his turn for a consideration amounting to 75 or 100 rubles per car, while the ore itself is worth only 50 rubles and the freight to Poti costs only 75 rubles per car.

In order to make sure of their requirements of 5,000,000 poods per year, the Russian consuming industries have secured from the Government an order giving them the exclusive use of 30 out of the 300 cars on the railroad from Tschiatura to Zweig. This move was vigorously opposed by the foreign exporters. It is in line with the declared intention of the Russian Government to stimulate metallurgical industry in the southeast, particularly the manufacture of ferro-manganese and spiegeleisen.

German Metal Trade in 1907

Imports and exports of metals in Germany, other than iron and steel, are reported as below for the year ended Dec. 31, in metric tons:

	Imports.	Exports.	Excess.
Copper	124,072	6,113	Imp. 117,959
Copper alloys, etc.	19,886	56,406	Exp. 36,520
Tin	12,814	4,244	Imp. 8,570
Tin manufactures	206	2,604	Exp. 2,398
Lead	74,973	27,708	Imp. 47,265
Lead alloys, etc.	227	10,575	Exp. 10,348
Spelter	28,459	62,238	Exp. 33,779
Zinc manufact'res	1,384	31,436	Exp. 31,052
Nickel and alloys	2,294	1,265	Imp. 1,029
Aluminum	3,974	1,926	Imp. 2,048

Imports and exports of ores, other than iron and manganese ores, were, in metric tons:

	Imports.	Exports.	Excess.
Gold ore	95	.....	Imp. 95
Silver ore	3,506	47	Imp. 3,459
Copper ore	19,295	20,950	Exp. 1,655
Lead ore	137,861	1,296	Imp. 136,565
Tin ore	9,971	106	Imp. 9,865
Zinc ore	184,703	34,863	Imp. 149,840
Nickel ore	29,296	.....	Imp. 29,296
Tungsten ore	2,248	195	Imp. 2,053
Uranium & other ores	1,159	.....	Imp. 1,159
Chrome ore	19,508	149	Imp. 19,359
Pyrites	742,526	24,183	Imp. 718,343

Recent Explosions in Coal Mines

Methods Tending to Safety Have Not Advanced as Rapidly as Dangers Have Increased, Due to Deeper and More Distant Workings

BY H. M. CHANCE*

It is interesting and reassuring to find the ENGINEERING AND MINING JOURNAL prepared to discuss in somewhat more than a perfunctory manner, and as a result of special investigations, the possible causes of recent disastrous mine explosions. The fact that such disasters are possible must be considered a disgrace to the industry and a reproach to our lawmakers.

Unfortunately in this country we have no properly organized official method of inquiry into the cause of these accidents. As the safety of the persons employed, many of whom have families dependent upon them for support, is jeopardized by the danger of a recurrence of such disasters, it seems properly within the police powers of the States to enact preventive and corrective laws to lessen and remove the danger. This has been recognized by most of the States in which coal mining is prosecuted, and legislation has been enacted, which when enforced is more or less effective, but such legislation has not kept pace with our growing knowledge of the causes of mine explosions and of the best means of preventing them, nor have the States undertaken investigation or experimentation to enlarge or advance our knowledge of the causes contributing to explosive conditions.

Much of the legislation which has been enacted is defective by reason of the absence of effective penalties or of provisions for enforcing compliance with the law. In some of the States this legislation has tended to remove or reduce the pecuniary liability of the employer for damages, for where the State assumes supervision of the operation of mines through officially appointed or legally elected inspectors, compliance by the mine-owner with the law and with the instructions of the mine inspector thereunder, may be sufficient to relieve him from liability for damages to the individual who may be injured, or to the heirs of him who may be killed. Legislation capable of such interpretation tends to lessen the anxiety of the operator, and while stimulating his desire to comply strictly with the law, may cause him to be less eager to reach out after better methods or appliances.

In view of these considerations it may be doubtful whether any greater measure of safety has been attained through the enactment of such laws as have been passed in this country. It seems extraordinary that while in most branches of industrial achievements the United States stands in the front rank, in this particular field we appear to have been content to wait while other nations act; to disregard precautionary measures which have been prescribed, or introduced and found effective, in other countries.

To understand the present status, it is necessary to review at some length the physical and economic conditions under which the coal-mining industry in the United States has been developed to its present stage. The industry has developed more rapidly than in any other country, under more severe competitive conditions, and the exactions of capital have been greater than in countries where lower rates of interest prevail.

WHEN GASES WERE FIRST ENCOUNTERED

Our first experience with explosive mine gases was in the anthracite coalfields of Pennsylvania and the bituminous coalfield of Richmond, Virginia. The latter was a small and unimportant field and the experience there gained was not an element in molding the systems of bituminous mining in other portions of the United States. In the anthracite coalfields, explosive gases were encountered almost from the outset, and exerted an influence upon the methods devised for working these coals. It was not, however, until some disastrous explosions had occurred that effective precautionary measures were prescribed.

At an early stage in the development of the district, the operators became divided into two classes; first, those who believed that the best method of guarding against explosions was by removing the cause, and second, those who believed and held that the cause could not be removed, and that the best way to guard against the occurrence of explosions was by the use of safety lamps. Even up to the present time, the operators and engineers advising them are still divided between these two views of the subject. The concensus of opinion, however, among those who have given thought and attention to the subject seems to be that the best way to prevent explosions is to so dilute the gas by ventilation as to render it non-explosive and harmless. The early adoption of this view resulted in the establishment of a system, which by custom became almost universal throughout the district, which provided gangways and airways of large cross-sectional area, and fans of enormous capacity, which required the systematic splitting of the ventilating currents and, if necessary, the duplication of airways and gangways penetrating gaseous territory.

In inaugurating these systems, the operators were assisted, rather than retarded by the physical conditions and geological structure of the district. The first and most important fact was that the coal beds were large, and gangways and airways of large area could be driven and maintained without appreciably increasing the cost of mining; the thickness of the coal beds when lying flat justified the driving of gangways and airways separated by comparatively short intervals; where the veins were found at high angles of inclination, the gangways and airways were necessarily driven at close intervals, with connections from level to level, or from "lift" to "lift." As these methods became molded by experience into systems recognized as standard by a majority of operators, the minority adopted the same methods, and in this way certain systems became standardized and recognized throughout the region as the proper ones to be used.

THE POLICY OF NAKED LIGHTS AND LARGE FANS

Thus at a comparatively early day the approved method of combating the danger due to the presence of explosive gases was by the use of large fans, capable of passing immense quantities of air through the workings at a relatively low water-gage pressure, large airways, gangways and crosscuts so designed and planned that the gases given off in any part of the workings should be diluted far below the danger point, making the use of naked lamps safe in all parts of the workings. This condition, prevailing generally in the mines of the larger operative companies, has enabled these corporations safely to install and operate electric power underground for hauling, hoisting, lighting and pumping. Exceptions to this rule were usually confined to portions of the workings of mines in which even these systems were inadequate for effective dilution of the explosive gases, and in such cases some portions or panels of a colliery are worked by miners using safety lamps. But the prevailing practice has been to make the collieries safe for the use of open lamps, and to confine the use of the safety lamp to those engaged in driving gangways or airways into new territory, the inspection of the workings by fire

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bosses, and the inspection of the condition of the air in return airways.

In the development of the bituminous coalfields, the operators confronted physical and economic factors different from those of the anthracite regions. With the exception of the Richmond coalfield already referred to, the bituminous coals of the United States developed in the earlier stages of the industry were those of the Appalachian coalfields, and the beds first worked were those in the hills and mountains above water-level and usually lying nearly flat or horizontal. These beds are of moderate thickness, usually have a shale or slate roof which is not self-supporting, and those portions above water-level, and with a thin covering of overlying rocks, rarely give off explosive gases.

The system of mining which developed was one characterized by small airways and crosscuts. The first system, known as the "single-entry" system, was, as its name implies, one in which a single entry was driven in upon the coal, ventilation being effected by utilizing the workings as a return airway. This system being suitable only for mines of limited output, was soon displaced by the "double-entry" system, in which two entries are carried into the heart of the territory to be developed, one being used as a return airway, one as an intake, and one or both as haulage roads. To keep down the cost of maintenance it was necessary to make these entries comparatively narrow, for throughout the bituminous coalfields the roof generally is insecure and the cost of maintaining entries increases rapidly with their width. The adoption of this system soon became general and certain standards of hight and width came to be regarded as good practice.

Economy Necessary

Owing to the great length of the outcrops of the various bituminous coalbeds, presenting innumerable points at which the coals may be opened, the number of operators and operating companies increased rapidly and the competitive prices at which the product was sold provided but a small margin of profit to the operator. Economy in the development and operation of the mines was therefore a factor of prime importance and exercised a controlling influence in the development of the mining system, which, by practice and custom, came to be regarded as standard for certain conditions.

As the mines penetrated to considerable distances underground from the line of the outcrop, small quantities of gas occasionally were found, but in no case was the quantity considered an element of danger or incapable of being safely handled by ordinary methods. As the workings progressed the difficulty of securing adequate ventilation increased, and while in the earlier stages of development, ventilation was effected by small air-shafts and furnaces, the use of fans became necessary and at the larger mines mechanical ventilation by fans soon became general. But the difficulty still existed of attempting to circulate large quantities of air through long airways of relatively small dimensions. This was in part overcome by splitting the air current, and while this proved useful, it did not furnish a satisfactory remedy.

Explosions Began to Occur

The industry had reached this stage of development when explosions began to occur in various parts of the bituminous coalfields. In many cases these explosions were small and their effects purely local. From the outset the question was raised as to whether these explosions were the result of gas or dust. In some few cases no conclusive evidence of the presence of gas was disclosed, and as bituminous coal dust had come to be regarded as explosive, these occurrences were naturally charged to the presence of dust. At a later date, more disastrous explosions occurred at a number of mines, and while in most of these cases the previous existence of gas was known, the quantity present was not believed to have been sufficient to account for the severity and extent of the explosion.

Meanwhile mining engineers and operators, realizing that the "double-entry" system did not afford the means for proper ventilation of collieries extending a long distance underground, began the experimental use of the "three-entry" and "four-entry" systems. These systems were introduced to provide more efficient ventilation, to reduce the risk of explosions from gas, to give access to a large area from any given point as a center, and to increase the output by large haulage facilities.

As this development was progressing in the East, a number of disasters occurred which by some were attributed to gas, by some believed to be due to dust, and by others held to be due to the presence of both. At the same time developments of coalfields in other parts of the United States were progressing under conditions apparently more likely to result in danger from the presence of dust. In the East the mines are frequently damp or wet, and the air sufficiently humid to keep the dust from becoming dry, whereas in our Western coalfields little water is found underground, and the air is so dry that the ventilating current removes the last traces of dampness from the dust. Had the explosions occurring in Eastern mines, which by many were attributed to dust, been better understood, it is probable that some of the explosions in Western mines might have been avoided. But no thorough investigation of these Eastern disasters had been made, and no experiments had been undertaken to determine the relative explosive qualities of the dust of different coals under varying conditions.

Gas or Dust

Immediately after the explosions in the West, which were traced or thought to be due to dust, preventive measures were adopted and enforced at many Western mines. Whether similar measures are necessary in our Eastern mines remains to be determined.

For many reasons, it is natural for those connected with the management of a mine at which an explosion may occur to attribute the accident to dust; first, because probably every individual operator and certainly all of our large operating companies believe they have done everything, and have taken every possible precaution to prevent the accumulation of gas in dangerous quantity, such as would result in a disaster; and secondly, as preventive measures are not in common use for reducing or removing the danger of an explosion from dust, the mineowner does not feel that he is required to take precautions not taken by his neighbors and competitors. His position in this respect cannot forcibly be assailed, for we cannot as yet accurately formulate the conditions under which such explosions may occur, or the causes leading up to them. Hence, if it be shown that an explosion was the result of dust and not of gas, the operator assumes or asserts that the disaster was not one for which he should be held personally responsible.

At the same time there seems to be a feeling among many engineers and operators that some of these disasters are the result of admixtures of gas and dust, and this in part may account for the efforts recently made to increase the ventilation of many of our large bituminous operations; if the danger of dust exploding be increased by small percentages of gas, it seems probable that this danger will be reduced if the percentage of gas be diminished by increased ventilation. Whatever the actuating motive may be, there has been a notable tendency to increase ventilation by the use of larger and more powerful fans, for while until quite recently it was not considered good practice to use water-gage pressures of much more than 2 in., we now hear of fans in the market to supply the demand for pressures up to 4 and even 6 inches.

It is, of course, evident that with the existing systems in use in bituminous mining, the only method by which increased ventilation can be effected is by the use of increased pressure. Splitting of the ventilating current has been carried as far as possible, and the increased length of gangways requires higher pressures if larger volumes of air are to be circulated through the workings. Whether this be good practice or not must be left to the future to determine. The cost of ventilating by using high water-gage pressure, the increased leakage through brattices and stoppings, and the increased velocity of the ventilating current, are serious objections to this method of increasing ven-

tilation. The adoption of the "six-entry" system devised by the writer some years ago (a description of which may be found in the Trans. A. I. M. E. Vol. XXX, 1900) might aid in solving this problem.

The Many Remedies Suggested

It is, of course, apparent, that if dust be the sole cause of the recent disasters it is unnecessary to consider ventilation in discussing remedial measures. The evidence adduced in recent inquiries seems to have diverted attention from this phase of the subject. It having been shown that the most modern ventilating appliances and methods were used, further consideration of the possibility of gas as a cause, or even as a contributory cause having been dismissed, the conclusion follows that the explosions were caused by dust. Following this conclusion, there is an outcry against the method of blasting, against "shooting off the solid," against certain kinds of powder, against electric (chain) coal-cutting machines, or any machines that make dust, against the use of electricity in dusty mines, etc., and demands are made that the floors of the mines be swept clean and the dust removed, and that the floor and walls of the entries and working places be periodically sprinkled. Doubtless all of these precautionary measures may be useful; the problem is how and where they should be applied.

In some of our Western coalfields where experience appears to have demonstrated the occurrence of true dust explosions, the precautions taken to prevent them have involved the watering of the roads and working places, the saturation of the air with moisture by turning exhaust steam into the intake, the firing of shots by battery (or dynamo) after all the miners have left the mines, etc. Whether similar measures are necessary in our Eastern coalfields can be determined only after our knowledge of the explosive qualities of coal dust has passed far beyond its present stage.

In the West, the dust problem is complicated by the presence of gas and while the evidence proving the actual explosion of dust appears quite conclusive, it seems uncertain whether the explosions originate in a mixture of dust and air, or of gas, dust and air. From such evidence as is available concerning mine disasters in the East, it appears that gas had previously been detected in a majority of cases, and as explosions in workings of small extent located close to the outcrop of the coal are almost unknown, it is reasonable to assume that gas had some part in the origin or propagation of these explosions. The question of pressing importance is whether these or similar explosions of dust would be possible, if by more thorough ventilation the quantity of gas in every part of the workings was constantly maintained at a low percentage.

Whatever the ultimate solution of these problems may be, it seems certain that the mining methods now regarded as standard in the bituminous coalfields are inadequate to cope with the increasing danger and difficulty due to increased depth beneath the surface and increased distance of the working places from the mine outlets. But before better methods can be devised, more thorough knowledge of the conditions under which dust, or a mixture of gas and dust becomes explosive is required. This knowledge possibly may be secured by investigating the conditions at mines where such explosions have occurred (although the condition of a mine after an explosion is rarely favorable to such an investigation), may be found by experiment, or, perhaps, can only be obtained by experience.

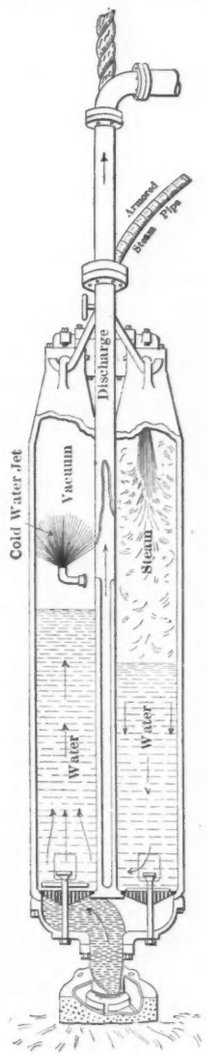
The suggestion editorially made by the Engineering and Mining Journal in its issue of Feb. 1, that the coal-mining States create commissions to examine into existing conditions and draft new laws to embody such provisions as may be necessary, is timely and practicable. Whether it would be possible to draft a law for enactment by all the States will depend upon the result of further investigation, for the provisions essential to safety in one district might be inappropriate or inapplicable to others.

The Emerson Steam Pump

The pulsometer pump has many advantages of construction over other types of pumps when water containing grit is to be handled; it is therefore especially adapted to shaft work. In such pumps, the water comes in contact with only four valves, two in the suction and two in the discharge pipes. As these are ordinary, flat-seated, rubber valves, they do not wear and get out of order easily when gritty water is being pumped. Besides, in pulsometer pumps there are no stuffing boxes, no plungers, no pistons, nor other moving parts such as cause trouble in reciprocating pumps, used for pumping dirty water. A pulsometer pump is self-contained; the valve, controlling the admission of steam to the cylinders, is situated in the top of the pump where it is not reached by the gritty water and where it is protected by the body of the pump from pieces of flying rock during blasting.

Another advantage of the pulsometer pump is that it can be easily moved, owing to its not requiring any foundation setting. On account of the absence of reciprocating parts, there is little vibration of the pump and so it can be hung from a rope while working; this permits of easy hoisting or lowering. Besides, as the steam acts directly upon the water without the use of plunger or piston, the pump is generally somewhat lighter than a reciprocating pump of the same capacity. As pulsometer pumps do not exhaust the steam into the air the shaft is therefore much cooler than when a sinking pump of the ordinary type is used. Pulsometer pumps can be worked when nine-tenths submerged.

The great drawback of pulsometer pumps has been the large amount of steam consumed. In a new pump of this type, made by the Emerson Steam Pump Company, of Alexandria, Va., it is claimed that the steam consumption is reduced by means of an early cut-off, resulting from the special design of the rotary slide-valve



EMERSON STEAM PUMP

steam ports. The Emerson pump, like other forms of pulsometer pumps, depends upon the vacuum in one chamber, produced by the condensation of the steam by means of a jet of water, to suck up the water into the chamber. Then by means of the rotary valve, steam is turned in on top of the water and the water is forced out of the pump by the steam itself.

On the Rand during the year ending June 30, 1907, there were 69 producing mines, using 8047 stamps which ran on the average 337.456 days. The tonnage hoisted amounted to 18,189,301 tons.

The Neill Process at Coconino, Arizona

By James W. Neill*

In the Journal of Jan. 18 there appeared an article by E. P. Jennings, entitled "The Neill Process at Coconino, Arizona." In justice to the process, of which I am the inventor, I beg that the same prominence may be given to the following statement in order that the reading public may be able to judge as to whether the failure at Coconino was due to the process or to the mechanical plant.

The Coconino mines are situated north of the Colorado river in Arizona, 150 miles from the nearest railroad. The company was floated by Chicago parties, headed by Henry M. Ryan and Peter L. Kimberly, upon reports made by Mr. Jennings, which showed the claims to contain several million tons of 8-per cent. copper ore. At about this time I had been developing the SO_2 process to work similar ores in San Juan county, Utah. After much persuasion I signed a contract with the parties named, by which they secured the sole rights for my patent for Coconino county and we started to make plans for the plant. It was my desire and advice to them to erect first an experimental 10-ton plant on the railroad at Salt Lake City, and in such plant to demonstrate as cheaply as possible the mechanical difficulties of the process. Such was their haste, however, that they insisted upon the immediate design of a 30-ton mill, to be placed at the mine. With the assistance of Mr. Gates, mechanical engineer, then in the employ of the Mine and Smelters' Supply Company, at Salt Lake, and with the constant advice and assistance of Mr. Jennings himself, we prepared plans for this plant and submitted the same for bids to the various machinery houses of Salt Lake City, Denver and Chicago. Much to our surprise none of these bids were accepted. Mr. Jennings departed for Chicago, and upon his return stated the contract for the erection of the mill had been let to Fraser & Chalmers, and he proceeded to the mill in charge of the construction of the plant.

Shortly after this I came into the possession of the blueprints of this plant and found them to be entitled "Fifty-ton Leaching Plant for Coconino Copper Company, designed by E. P. Jennings." Upon examination, these plans were found to differ in many material points from those prepared by us. I was never at the plant, nor was my partner, Mr. Burfeind. The attitude assumed by Mr. Ryan was unfriendly from the start. Upon inquiry as to how matters were going and what they would do, I was frequently informed that they were not using the Neill process, but were using a better one, the "Jennings process." Naturally enough, we were never paid any royalty; the company forfeited any rights to the use of the process and the matter dropped.

In frequent conversations with Mr. Jennings he assured me that the chemistry of the process was all right and had worked well, that the difficulties had been mechanical ones in the mill and leaching plant, and that with certain modifications the ore could be worked by this method. The weak points enumerated by Mr. Jennings in his article all point to the same conclusion, viz., that no attempt was made to better the mechanical failures of the plant. Referring to his numbers 1 and 2, our plan called for the placing of a rose upon the discharge of the gas pipe at the bottom of the tank in order that the gas should be broken up into little bubbles. Whether this was done or not I cannot say, but Mr. Jennings told me that the gas ascended through the tanks in great balloons, that these burst at the surface with sufficient force to shake the tanks and building, and for this reason they were unable to fill the tanks more than half full. As Mr. Jennings was present when the tests upon an average sample of the Coconino ore were made in our testing plant in Salt Lake City, he was well aware of the precautions which we took to break all these bubbles and to assist the agitation either by the introduction of stirring arms or of wooden gratings, or both, by which means the gas bubbles may be completely broken up. Our experiment showed an 11-per cent. ore to be completely extracted in the course of six hours.

His numbers 3 and 4 do not coincide at all with our practice either in the Salt Lake plant, or in the plant which we operated in Butte. We readily obtained solution carrying 2.5 per cent. copper, and so long as the solution remained cool no difficulty was experienced with the copper separating out in the sands or in washing out the same. The plant of which I speak at Butte was installed by us at the smelter of the Montana Ore Purchasing Company to test the process upon Butte ores. As these ores are sulphides they were roasted in ordinary Herreshof furnaces, temporary wood-burning fire-places being added to the lower half. The material was reduced to about 2 per cent. sulphur content. It was then placed in a wooden barrel 6 ft. in diameter by 12 ft. long, and SO_2 gas from the roasting furnace was blown through the hollow trunnions and brought into more intimate contact with the pulp by means of wooden paddles arranged on the sides and periphery of the barrel. We charged two tons of roasted ore with five tons of water, and after passing the dilute roasting gases through the barrel for six or eight hours were successful in extracting the copper. The barrel was dumped into a settling tank, the solution drawn off by percolation and the sands washed in the same way. This washing was difficult on account of the ferric oxide, which, being flocculent, remained in suspension and formed a layer upon the top of the sands which it was difficult to percolate. The sands after this incomplete wash averaged 0.8 per cent. copper, but average samples taken from the tank and washed by agitation and decantation, gave a final tails of 0.31 per cent. copper. The heads averaged 3.15 per cent. copper, showing an extraction of 90 per cent. The solution was heated in a wooden tank by a steam coil, and the precipitates, which were slightly contaminated by alumina, on account of the poor filtration, amounted to 64 per cent. of the copper extracted. The remainder was precipitated upon iron in a splash tank and the final solution turned to waste carried only traces of copper. The amount of iron consumed was exceedingly small and the reaction very quick, owing to the fact that the solution comes from the steam tank at nearly the boiling point.

We treated in this plant 35 tons of material, and the figured cost of the operation compared very favorably with anything being done at that time or now in the Butte district. The process was not adopted because at that time the silver content of the company's ore was high and could not be saved by this method, and furthermore, the space necessary for the plant was not available.

Since the erection and failure of the Coconino plant there has been nothing done toward the exploitation of this method. Any effort to do so has always been met by the ghost of that Coconino failure. I think, however, in justice to this meritorious chemical process that that miscarriage at Coconino should not be allowed to stand in the way of further experiment, and it is my intention to make this demonstration under my personal direction.

*Consulting mining engineer, Salt Lake City, Utah.

According to *Echo des Mines,* December 12, 1907, the exports of tungsten ore from Portugal increased from 9 tons in 1905 to 336 in 1906. The chief mines Penasqueira; Cabeco do Pinhao; Cabeco do Seixo, in the district of Castello Branco; Mont' Alegre, in Villa Real; Serra das Pedras and Villa Nova de Parva in Vizeu; Vieira, in Braga. The total production of 1906 is given as 570 tons.

Judge E. H. Gary, chairman of the Steel Corporation, at the annual dinner of the Illinois Society in New York, Feb. 7, said: "Reiteration of the oft-stated principles of the President of the United States has increased my feeling of responsibility toward the stockholders I represent, toward our competitors, toward business men, and toward the public. I don't hesitate to make this confession. According to my belief, business is done on a better basis and on a higher plane because of what I have referred to."

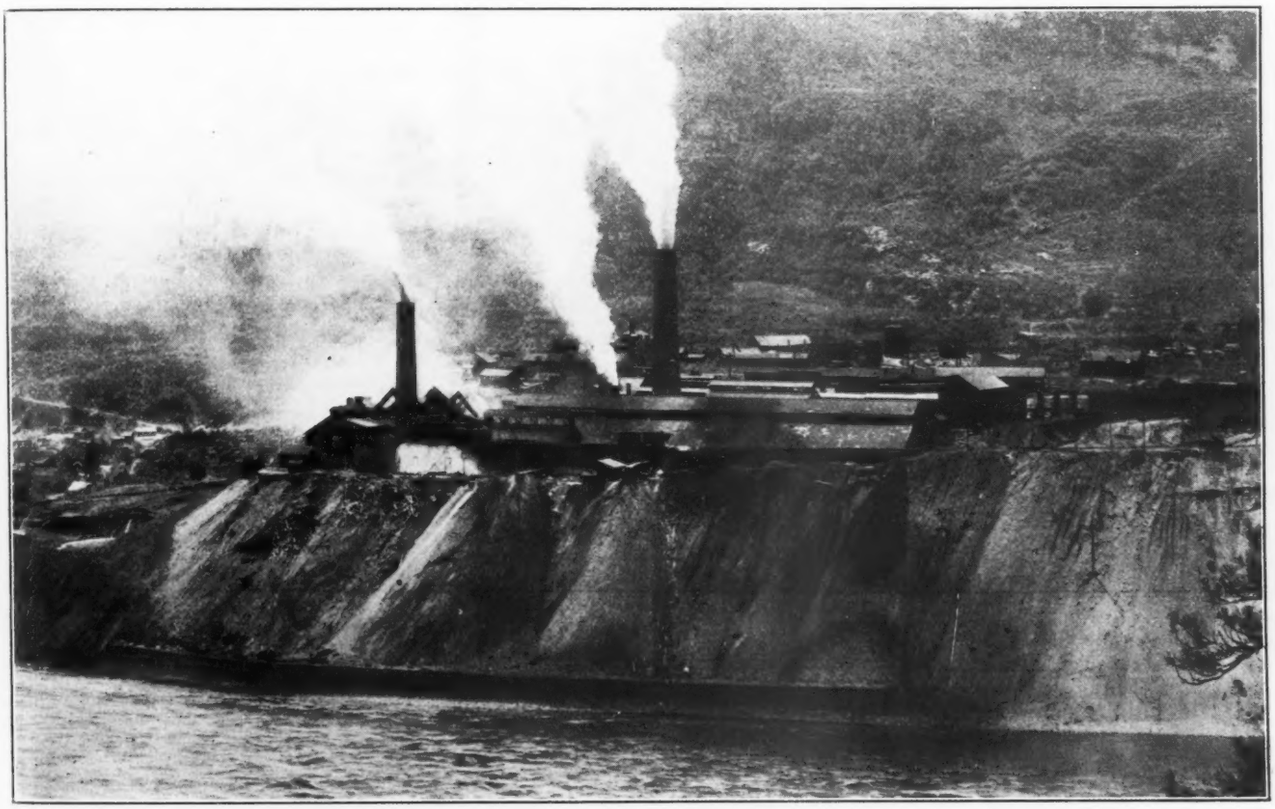
Consolidated Mining and Smelting Company of Canada, Limited

The annual report of the Consolidated Mining and Smelting Company of Canada, Ltd., for the year ending June, 1907, shows that dividends to the amount of $500,005 were paid during the year on an issued capital stock of $4,833,800. The total assets, including mines, mineral claims, options, leases, mining, smelting, concentrating and refining plants, ores and products on hand or in transit, stores and cash amounted to $6,811,150. The mining, smelting and general expenses were as follows: St. Eugene mines, $389,832; Centre Star, $266,955; Snowshoe, $71,059; Trail smeltery and refinery, $934,853. The sale of smelter products, profit on refining, etc., yielding $4,062,129; while from the sale of ores $812,263 was obtained.

The managing director in his report says: "The profits of the company for the year have been unfavorably affected by two strikes in the coalfields, which shut off the fuel supply for the mines and smelter; the severe winter of 1906 and 1907, and the unsettled and unsatisfactory labor conditions, all of which greatly restricted mining, smelting and refining operations, and resulted in increased costs as compared with previous years. As an illustration of the effect of these adverse conditions, the tonnage mined in Rossland and smelted at Trail for the year only slightly exceeded the tonnage mined and smelted during the six months ending June 30, 1906."

Production

The gross value of metals produced during the year at the company's smelting works was $3,786,146, of which $1,657,365 came from the company's own properties. Of the mines, the Centre Star and War Eagle produced 81,788 tons of ore, 32,306 oz. gold, 27,808 oz. silver, and 1,030,529 lb. copper, of a total value of $893,249. The St. Eugene produced 127,645 tons of ore, 675,959 oz. silver, and 29,391,389 lb. lead, the total value being $1,713,933. The Snowshoe yielded 49,002 tons of ore, 2989 oz. gold, 16,171 oz. silver, and 1,372,656 lb. copper, having a total value of $397,141. The Trail smelter treated 222,573 tons of ore producing 69,168 oz. gold, 1,100,271 oz. silver, 20,383,083 lb. lead, and 3,443,310 lb. copper.



TRAIL SMELTER, TRAIL, B. C. CAPACITY IN COPPER AND LEAD ORES, 1500 TONS DAILY. CAPACITY OF LEAD REFINERY, 80 TONS LEAD BULLION DAILY

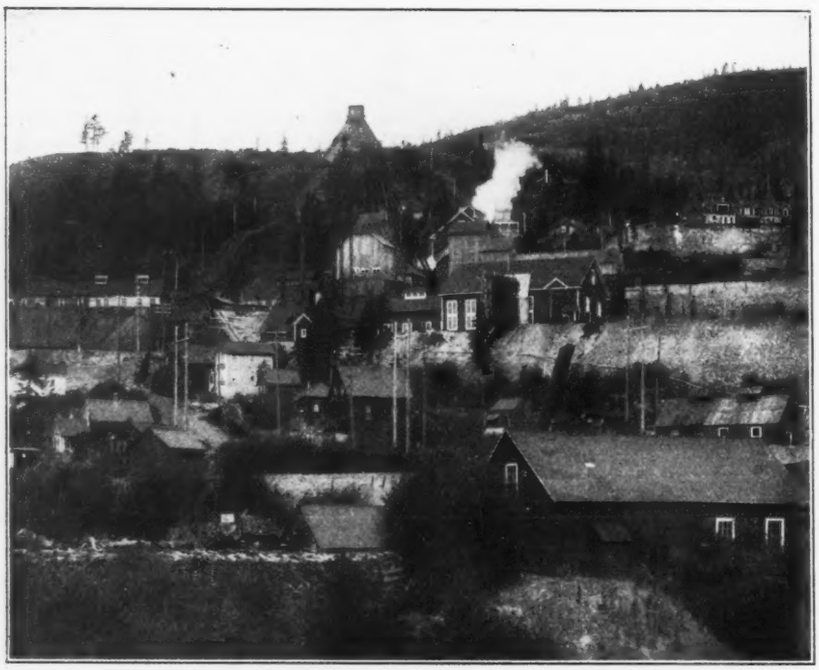
Development

Underground development or narrow work in the Centre Star and War Eagle amounted to 16 miles; and that in the St. Eugene 10 miles. Drifting in the Centre Star measured 4186 ft.; in the War Eagle, 2599 ft., and in the St. Eugene, 9486 ft. Crosscutting amounted to 1526 ft. in the Centre Star, 1298 ft. in the War Eagle, and 1610 ft. in the St. Eugene. Raising and sinking in the St. Eugene reached totals of 2417 ft. and 339 ft., respectively; in the Centre Star, 811 ft. and 337 ft.; and in the War Eagle, 574 ft. and 131 ft.

The managing director's report continues: "In the Centre Star a large tonnage has been developed in the east orebodies above the 5th level. The 11th level has developed six ore shoots, the largest having a width approaching 40 ft. Several of these have yielded ore of a considerably better grade than the average mine-run from the Centre Star group. The east ore-shoot which started at the 6th level, was found to be of greater length on the 11th level than at first supposed, and although it is not wide, yet it is of good grade. Three ore-shoots west of the shaft have turned out satisfactorily. The 12th level has been extended the full length of the property, and only two pay orebodies have as yet been located, one being the continuation of the main east ore-shoot, which was small, but in places contained very high-grade ore. There is still a large amount of crosscutting to be done upon this level, and there are a number of places where sufficient ore has been found to justify starting raises. The main Centre Star shaft is down below the 14th level, and stations have been cut on the 13th and 14th levels and crosscutting for the vein started.

"A fair tonnage of ore is being found in the upper levels of the War Eagle, particularly around the 4th, 5th and 6th levels, where in some cases the orebodies had faulted. In the lower workings, the

chief feature has been the development between the 10th and 12th levels, where a tonnage of high-grade silicious ore is being developed. A small shoot of heavy sulphide rich in copper has also been found. There still remains a large area of country to prospect between the 8th and 12th levels, as the old War Eagle drifts below the 8th level were run in the foot-wall of the vein.



CENTRE STAR MINE, ROSSLAND, B. C.

"Nearly all of the shipments from the Iron Mask have come from new ore, the old ore reserves, which had been developed at the time of purchase, not having yet been materially drawn upon. The Iron Mask orebodies are for the most part small, but in cases, quite long and yield a good grade of ore. There are fair prospects of continuations of the old veins being found, and a possibility of new ones located.

"On the Idaho property, which has recently been acquired, a vein about 30 ft. wide has been discovered near the middle of the claim. A small prospecting shaft is being sunk, and at the start yielded fair values, but recently has been in a fault, since which time the ore has been of low grade. The 4th, 7th, 8th and 12th Centre Star levels have been extended into the Idaho ground. A large part of the distance driven was through the large dike which forms the Centre Star gulch. The assays in the lower levels have been somewhat discouraging, but on the 4th level there are good prospects of locating orebodies containing pay ore. At several points mineralized ground was encountered, which will require more thorough prospecting.

"Development of the Snowshoe has been satisfactory. The main increase in ore reserves since leasing the property has been due to the opening up of the Gold Drop branch ore vein. Diamond drilling below the main fault has not located any ore.

"At the St. Eugene mine, Moyie, large orebodies in the cross veins have been found. These are known as 3d and 4th avenues. The 3d avenue ore-shoot, found by diamond drilling, has been located on the 1700-, 1800-, 1900- and 2000-ft. levels. In the south vein, just above the 2000-ft. level, an ore-shoot 30 ft. wide of fair grade of ore has been found. The 2100-ft. level has not shown up any large orebodies, but it will require some months to prospect. There are indications that the south vein may in the future prove to be more productive than the main vein, and there is every reason to hope that other cross fissures containing ore will be found.

ST. EUGENE MILL, MOYIE, B. C.

"The Richmond-Eureka group at Sandon promises to yield a small tonnage of high-grade ore. Tunnels Nos. 2, 3, 4 and 5 have been driven, and in some cases small rich orebodies located. One carload of ore encountered in development was shipped which yielded $3,305.47, and there is more ore on the dump. Before other shipments are made an aërial tramway will be built.

"The ore reserves in Rossland have been materially increased since the last report, while the developed tonnage at the St. Eugene is about the same as that of June 30, 1906. The probable Snowshoe tonnage has been increased.

"At Rossland, all the underground workings between the Centre Star, War Eagle and Iron Mask have been connected by the driving of several long crosscuts on the different levels, in order that all of the ore from these properties might be handled through the main Centre Star shaft. Electric haulage has been installed on the 350, 4th and 9th levels, the 350 and 9th being for the handling of all War Eagle and Iron Mask ore below the second level.

Construction and Improvements

"During the year a large amount of

new construction and improvements at the various properties was completed or nearly completed. The main items were as follows:

"At Rossland mines, the enlargement of the Centre Star compressor plant, and the purchase of an electric motor for driving the old Centre Star compressor (to replace steam); a Nordberg hoist (with new head works) for handling the ore from the Centre Star, War Eagle, Iron Mask and Idaho mines; an ore conveyer, sorting and complete sampling plant; electric haulage on several levels underground and on the surface; additional fire and water systems; additional equipment for shops.

"At the St. Eugene, numerous improvements and additions to the concentrating mill; additional fire protection; additional machinery for shops; improvements in power plant and boiler house; improvements to hoisting plant.

"At the Snowshoe, additional fire and water systems; installation of electric haulage; new compressor drive; enlargements and new equipment for shops; additional buildings.

"At Trail, enlargements of copper furnaces and lead furnaces; installation of the Huntington-Heberlein plant; construction of new copper mill bins and trestles; additional electric locomotives and electric haulage; additions to the refinery lead plant; the building of the acid plant; the addition of an antimony plant.

New Properties

"During the year the Iron Mask property at Rossland, on account of the large orebodies located in the eastern part of the Centre Star mine, next the Idaho claim, the surface showing, which indicated a continuation of the main Le Roi-Centre Star vein through the Idaho claim, and because of the cheapness with which this property could be developed from the various Centre Star levels which had been driven to the Idaho line the Consolidated Company acquired the Idaho claim for part cash and part shares in the Consolidated Company.

"As the main Le Roi-Centre Star vein can be traced through not only the Idaho claim, but also through the Enterprise property, joining the Idaho on the east end line, it was decided to purchase this property for cash. This gives the Consolidated Company 4500 ft. on the main Le Roi-Centre Star vein.

"In view of the recent favorable developments on the Snowshoe, Gold Drop and Rawhide properties, all in Phœnix camp, it was considered advisable to purchase the Phœnix Amalgamated Company's properties, and negotiations for the acquisition of these interests were completed June 30, since which time the actual purchase has been made. The Phœnix Amalgamated Company's properties comprise the following claims: War Eagle, Missing Link No. 2, Dandy, Bald Eagle, Pin Hook, Red Rock, Lulu and some fractions, the total acreage being about 210.3. These properties adjoin the Granby Consolidated Company's properties upon the south.

"Negotiations were also completed June 30 for the purchase of the Four Ace and Keystone properties, adjoining the Phœnix Amalgamated group on the south. Several options have been taken on other properties near Phœnix.

"To provide a sufficient supply of lead ore for the furnaces and refinery at Trail and to insure a sufficient lead tonnage to enable the company to retain its strong position in the Canadian, Chinese, and Janapese lead markets, an agreement was made with the Canadian Metal Company, by which the Consolidated Company is to advance $125,000 for development and the construction of a lead concentrator at the Blue Bell mine (said advance being secured by mortgage upon the Blue Bell mine and concentrator, and Frank zinc smelter), and in consideration of the above the Consolidated Company has secured the Canadian Metal Company's entire output of lead and zinc concentrates for a period of years."

The Canadian Mining Institute

Editorial Correspondence

The tenth annual meeting of the Canadian Mining Institute began in the city of Ottawa on Wednesday, March 4. The attendance at the opening meeting was large, and was increased considerably the second day. As a number of members were reported as delayed in reaching Ottawa by the heavy snowstorm of the preceding day, it was decided to postpone the business meeting until Thursday morning.

The First Day's Meeting

The president, Frederick Keffer, of Greenwood, B. C., opened the meeting with a few well chosen words. Hon. W. Templeman, Dominion Minister of Mines and Inland Revenue, then made an address welcoming the institute and showing the work which his department had begun, its new organization and what it hoped to accomplish. He spoke of the importance of the institute, complimented it on the good work it was accomplishing, and assured it that it had the support of the department of which he was the representative.

Appropriate responses were made, and the reading of papers began, and was continued, with only a brief recess, during the afternoon. The principal papers read were: The Classification of Coal, by D. B. Dowling, Ottawa; The Carbon Minerals of New Brunswick, Dr. R. W. Ells, Ottawa; Secondary Mining Education, H. H. Stoek, Scranton, Penn.; and Compilation of Mining Statistics, J. McLeish, Ottawa.

Mr. Dowling's paper called out a long and interesting discussion, in the course of which Prof. J. B. Porter described the tests of Canadian coals which had recently been begun at the mining laboratory of McGill University under the auspices of the Dominion Government. The discussion turned largely to the best methods of coal analysis, and the value of such determinations. Dr. Ells' paper was also discussed at length. In the discussion on mining statistics several plans were suggested for securing better coöperation among the Dominion and provincial mining departments in the collection and statement of statistics.

Mr. Obalski, chief of the Department of Mines of Quebec, presented the mineral statistics of that province, and Mr. Gibson, Deputy Minister of Mines, presented those of Ontario. Mr. Obalski also presented a paper on Gold in the Eastern Townships of Quebec.

The Evening Session

At the evening session Dr. W. Campbell, of Columbia University, New York, presented a paper on Metallography Applied to Engineering. This was illustrated by a number of lantern slides, showing methods of using apparatus and many sections of metals and alloys. D. B. Dowling read a paper on Prospecting for Coal in the Rockies, illustrated by some beautifully colored lantern slides taken on the eastern slopes of the Rocky mountains in Alberta and Saskatchewan. Dr. Campbell's paper was discussed at some length by Messrs. Porter, Wilmott, Gwillim, and others; Mr. Dowling's paper by Messrs. Adams and Hobart.

Elfric Drew Ingall, Ottawa, read a paper on a System of Conventional Signs for Showing Mineral Occurrences on Maps. This was also illustrated by lantern slides.

The Business Meeting

The business meeting was held on Thursday morning. The president, Frederick Keffer, of Greenwood, B. C., in his brief annual address, referred to the coming visit to Canada of the London Institute of Mining and Metallurgy, which is coming next autumn on the invitation of the Canadian institute. The London institute delegates, if possible, will visit all the mining centers, including British Columbia. Mr. Keffer expressed gratification at the increase in membership from 500 to 700 during the year, but deprecated the dissension which seemed developing between members in Ontario and Quebec. Such dissension, he said, endangered the life of the institute and some of the members in British Columbia favored forming an independent institute of Western mining men. Personally he strongly favored the preservation of the national character and

scope of the institute, as independent provincial institutes would be suicidal. The president also referred in appreciative terms to the move by the institute to have branch libraries in various mining centers.

The secretary, H. Mortimer Lamb, read the report of the council, which referred to the establishment of three branches of the institute; Western branch at Nelson, with A. B. W. Hodges, Grand Forks, as president, and E. Jacobs, Victoria, secretary; Cobalt institute, A. A. Cole, president and G. R. Harty secretary, and the Eastern branch, at Montreal, with George E. Drummond as president and J. W. Bell as secretary. Appreciation was expressed at the formation of the Dominion department of mines and the increase of the Dominion government grant to the institute from $3000 to $5000. Mr. Lamb reported that Frank E. Lathe, of McGill University, had been awarded the president's gold medal for the best paper by a student member. Statistics of the membership of the institute were given; also an account of several deputations sent by the council to appear before the Government on mining taxation and other questions.

The report of the treasurer, J. Stevenson Brown, Montreal, showed the gross receipts for the year, including a balance of $1354 from 1906, of $11,396. The disbursements amounted to $7923, leaving a balance on hand of $3472. The receipts included a Dominion government grant of $5000, a Provincial grant of $1500, and membership fees, $4362.

The appointment of scrutineers called out some sharp debate between the two parties who favored different candidates. It was ended by the election of Frederick Hobart, New York—whose name was presented by both parties—R. W. Brock, of Ottawa, and A. W. G. Wilson, of Montreal. The proposed amendments to the by-laws were then taken up and discussed at length by Messrs. Porter, Miller, Haultain, Goodwin, Hobart, Coste and others. Of the two more important amendments, one relating to the appointment of a nominating committee by the council was defeated. The other transferring the election of secretary and treasurer from the members at large to the council was carried. This will not take effect until next year.

A motion, of which notice had previously been given, was brought up to remove the headquarters of the institute from Montreal to Ottawa. This was also discussed at length, the relative advantages of the political capital and a commercial center being presented. It was finally ordered that the question be referred to a letter-ballot of all the members.

The Afternoon Session

The afternoon session was especially devoted to the iron industries, being opened by a valuable paper on the Iron Ores of Canada, by Prof. C. K. Leith, of Madison, Wis., which was discussed at length by Messrs. Coste, Barlow, Hedley, Obalski and others. Other papers read were, the "Iron Ores of Ontario," A. B. Willmott, Saulte Ste. Marie; "Electric Smelting in Ontario," R. Turnbull, St. Catharines; and "Possibilities of Electric Smelting," Dr. A. Stansfield, McGill University, Montreal. All these papers called out interesting discussions.

The secretary was directed to send appropriate messages of sympathy to Dr. Albert P. Low, deputy minister of mines and head of the Geological Survey, who is at present disabled by severe illness.

Mining Law

The Friday session was largely devoted to the discussion of the mining laws of the Dominion and the Provinces. It was opened by a careful and elaborate paper by Dr. W. G. Miller, in which he said that people had not yet got away from the idea that Canada is an agricultural country first and a mineral country secondarily. He advocated briefly that mining rights should be retained when surface rights were disposed of, which would tend to avert such legal troubles as now tied up much available property around Lake Superior, and that further, an acreage tax should be levied on all mineral rights to clear up these titles. He pointed out that few in Ontario had taken advantage of the opportunity afforded to make tests for six months on mineral lands and then, if thought profitable, take these over in the regular way.

Messrs. Tyrrell, Willmott, Clark and others discussed mining titles and taxation at length. Finally the following was adopted without objection:

"In view of the increasing importance of mines and mineral lands subject to the jurisdiction of the Dominion Parliament, it is resolved that the Canadian Mining Institute memorialize the Dominion Government to inquire into the whole matter and to draft mining laws to be submitted for the consideration of the Dominion Government, and that as one of the arguments in support of the appointment of such a royal commission that it be urged that when a statute to be enacted by the Dominion Parliament declares with clearness, conciseness and certainty the law relating to mines and mining under Federal control, such a statute would, as far as local conditions would permit, be followed by the various provinces, thus insuring as far as practicable, uniformity in laws throughout the Dominion."

A short paper on the Moose mountain iron-ore deposits prepared by Mr. N. E. Leech, Sudbury, Ont., was read.

Resolutions were passed memorialing the Dominion Government and Parliament in favor of the continuance of the bounty on lead produced from Canadian ores, and raising the limit of price above which no bounties are paid.

The Election

Frederick Hobart, as chairman, reported that the scrutineers had had an unusually difficult task, partly on account of the large vote and the number of candidates, but chiefly on account of the obscure and inconvenient form of ballot used. Recommendations for the improvement of this ballot were presented. The scrutineers had received 316 ballots, of which 24 were rejected as irregular in form, unsigned, etc. The following candidates had received a majority of votes and were declared elected:

President, W. G. Miller, Toronto, Ont. (unanimously).

Vice-presidents, W. Fleet Robertson, Victoria, B. C., and G. R. Drummond, Montreal.

Secretary, H. Mortimer Lamb, Montreal.

Treasurer, J. Stevenson Brown, Montreal.

Members of Council: Charles Fergie, Glace Bay, N. S.; J. E. Hardman, R. H. Drury, R. T. Hopper, Montreal; Arthur A. Cole, Cobalt, Ont.; J. B. Tyrrell, Toronto, Ont.; R. H. Stewart, Rossland, B. C.; W. M. Brewer, Victoria, B. C.; A. J. McNab, Trail, B. C.; O. B. Smith, Phœnix, B. C.; R. W. Robb, Amherst, N. S.; W. F. C. Parsons, Londonderry, N. S.

On motion, Dr. A. E. Barlow, Ottawa, was chosen a vice-president to fill the unexpired term of Dr. Miller, elected president.

The meeting then adjourned until next year, after passing the usual votes of thanks.

Entertainments

The business of the meeting was so engrossing that little time was left for entertainments. On Thursday evening a smoking concert was given, which was much enjoyed. On Friday, during the recess, many members visited the Geological Survey museum, which is the nucleus of the proposed national museum.

The annual dinner was held on Friday evening. Among the speakers in answer to the toasts were William Templeman, Minister of Mines; Senator Bostock; W. F. Cockshutt, Duncan Ross and E. M. McDonald, members of the Dominion House of Commons; Frederick Keffer, retiring president; W. G. Miller, the new president; Dr. E. Haanel, Dr. R. M. Coulter, J. Obalski, R. W. Brock, A. E. Willmott, Frederick Hobart, R. G. Leckie, H. M. Lamb and J. C. Murray.

Papers Presented

The number of papers presented for this meeting was so large that a number were read by title only. The list is as follows:

1. The Iron Ores of Canada, by Prof. C. K. Leith, University of Wisconsin, Madison, Wis.

2. The Iron Ores of Ontario, by A. B. Willmott, Sault Ste. Marie, Ont.

3. The Iron and Steel Industries of Ontario, by J. G. Parmelee, Sault Ste. Marie, Ont.

4. The Use of Charcoal as Blast Furnace Fuel in Northern Ontario, by R. H. Sweetzer, Columbus, Ohio.

5. Electric Smelting in Ontario, by R. Turnbull, St. Catherines, Ont.

6. Possibilities of Electric Smelting, by Dr. A. Stansfield, McGill University, Montreal.

7. A New Iron Ore Field in Eastern Canada, by John E. Hardman, Montreal.

8. The Moose Mountain Iron Ore Deposits, by N. E. Leech, Sudbury, Ont.

9. The History and Progress of the Iron and Steel Industries of Nova Scotia, by Arthur P. Scott, Sydney, N. S.

10. Progress with the Gröndal Process of Concentration and Briquetting of Iron Ores, by P. McN. Bennie, Niagara Falls, N. Y.

11. The Carbon Minerals of New Brunswick, by Dr. R. W. Ells, Ottawa.

12. Utilization of Waste at Lille Colliery, by W. A. Davidson, Blairmore, Alta.

13. The Classification of Coal, by D. B. Dowling, Ottawa.

14. The Reduction of Ash in Coal for Coke Making Purposes and how it is accomplished at Lille Colliery, by Raoul Green, Frank, Alta.

15. On a Method of Identifying a Coal Seam in any Given Basin, by Dr. H. M. Ami, Ottawa.

16. The Utilization of Peat for Industrial and Metallurgical processes in Ontario, by E. Nystrom, Ottawa.

17. The Mode of Occurrence of Canadian Graphite, by H. P. H. Brumell, Buckingham, Que.

18. Notes on the Natural Gas at Three Rivers, Que., by John E. Hardman, Montreal.

19. The Metallurgy of the Cobalt Ores, by F. N. Flynn, Cobalt, Ont.

20. Sampling of Silver-Cobalt Ores, by Arthur A. Cole, Cobalt, Ont.

21. General Mining Conditions in the Cobalt District, by Frank C. Loring, Toronto, Ont.

22. Laboratory Experiments on Special Methods of Cyanidation of Cobalt Ores, by J. W. Bell, Montreal.

23. The Origin of the Silver of James Township, by Dr. A. E. Barlow, Ottawa, Ont.

24. Observations on the Geology and Ore Deposits of Camp Hedley, B. C., by Charles Camsell, Ottawa.

25. Notes on Costs of Diamond Drilling in the Boundary District, by F. Keffer, Greenwood, B. C.

26. Handling Three Thousand Tons of Ore Per Day at the Granby Mines and Smelter, Phœnix and Grand Forks, B. C., by A. B. W. Hodges, Grand Forkes, B. C.

27. Methods of Mining at the Granby Mines, Phœnix, B. C., by C. M. Campbell, Phœnix, B. C.

28. Some Notes Relative to the Copper River District, Alaska, by W. M. Brewer, Victoria, B. C.

29. Some Whitehorse Ore Deposits, by R. G. McConnell, Ottawa, Ont.

30. Some Western Methods of Assaying, by C. S. Baker, Greenwood, B. C.

31. A Partial Bibliography of Publications Referring to the Geology and Mineral Industry of Alberta and British Columbia, by J. C. Gwillim, Kingston, Ont.

32. Dredging and Its Possibilities, by A. E. Hepburn, Vancouver, B. C.

33. Some Notes on Labor Saving Devices to Cheapen Copper Smelting, by R. C. Campbell-Johnston, Vancouver, B. C.

34. Topographical Methods used for the Special Map of Rossland, B. C., by W. H. Boyd, Ottawa.

35. Metallography Applied to Engineering, by Dr. W. Campbell, Columbia University, New York.

36. Gold in the Eastern Townships of Quebec, by J. Obalski, Quebec.

37. A Few Notes on the Lluvia de Oro Mine, State of Chihuahua, Mexico, by J. W. Bell, Montreal.

38. Minerals and Ores of Northern Canada, by J. B. Tyrrell, Toronto, Ont.

39. Note on a System of Conventional Signs for Showing Mineral Occurrences on Maps, etc., by E. D. Ingall, Ottawa, Ont.

40. Laboratory Experiments on Certain B. C. Ores by the Flotation Process, by Dr. J. Bonsall Porter, Montreal.

41. The Comparative Amount of Slime Produced by Crushing in Different Types of Fine Crushers, by Dr. J. B. Porter and G. Stroutt, McGill University, Montreal.

42. Notes on the Experimental Electrostatic Separator, by J. C. Kemp and K. B. Carruthers, McGill University, Montreal.

43. Notes on Mining Laws, by Dr. W. G. Miller, Toronto, Ont.

44. On Secondary Education, by Dr. H. H. Stock, Scranton, Penn.

45. The Compilation of Mining Statistics, by J. McLeish, Ottawa.

46. Utilization of Water Falls, by Hilder Daw, Montreal.

47. Notes on the Elmore Vacuum Process, by H. H. Claudet, Rossland, B. C.

48. The Duties of Mining Engineers, by J. D. Kendall, London, England.

49. Occurrence of Tungsten Ores in Canada, by Dr. T. L. Walker, Toronto.

The students' papers presented in competition for the annual prize of the Institute were as follows:

1. Operations of the Modern Blast Furnace, by K. S. Twitchell, School of Mining, Kingston.

2. Micro-Chemical Tests on Ores, by F. S. Sine, School of Mining, Kingston.

3. Petrography of the Lardeau District, by J. Hill, School of Mining, Kingston.

4. Iron Ore Deposits of the Eastern Ontario Gold Belt, by S. J. Schofield, School of Mining, Kingston.

5. Magnetic Prospecting in the Sudbury District, by M. Y. Williams, School of Mining, Kingston.

6. Coal Mining in Southern British Columbia, by W. M. Harding, School of Mining, Kingston.

7. Manufacture of Coke in Alberta, by J. P. Cordukes, School of Mining, Kingston.

8. Notes on Mining in the Yukon, by A. A. Paré, McGill University, Montreal.

9. The Rossland Mines and the Consolidated Mining and Smelting Company, by H. J. Carmichael, McGill University, Montreal.

10. The White Bear Mine, Rossland, B. C., by H. H. Yuill, McGill University, Montreal.

11. Note on the Method of Mining at the Brooklyn Mine, Phœnix, B. C., by E. E. Campbell, McGill University, Montreal.

12. The Occurrence and Method of Treatment of the Nickel Plate Gold Ore at Camp Hedley, by A. O. Hayes, McGill University, Montreal.

13. Notes on the Oilfields of Trinidad, by Sydney Ells, McGill University, Montreal.

Hitherto Unpublished Statistics of Joplin Lead and Zinc Ores

By Doss Brittain*

The following statistics of the production of lead and zinc from the Joplin district are of interest, not having hitherto been made public. They were compiled by E. St. George Noble, of Galena, Kan., who built one of the first lead smelteries in the district.

The first table gives the production of zinc ore in the Joplin district from 1873 to 1894, the second column indicating the production in tons of 2000 lb.; the third, the average price for the year; the fourth, the total value.

PRODUCTION OF ZINC ORE

Year.	Tons.	Average Price.	Total Value.
1873	690	$9.00	$6,210
1874	5,100	10.00	51,000
1875	3,600	12.00	43,200
1876	11,000	13.50	148,500
1877	10,000	14.00	140,000
1878	12,000	16.50	198,000
1879	20,000	17.00	340,000
1880	27,500	16.00	440,000
1881	49,700	16.50	820,050
1882	52,200	16.90	882,180
1883	53,900	17.50	943,250
1884	63,600	18.00	1,144,800
1885	65,600	17.50	1,148,000
1886	75,400	18.50	1,394,900
1887	86,200	19.00	1,637,800
1888	89,700	20.00	1,786,000
1889	98,440	24.00	2,362,560
1890	114,900	23.00	2,642,700
1891	143,650	22.00	3,160,300
1892	148,150	22.50	3,333,375
1893	134,090	19.25	2,581,232
1894	134,300	17.25	1,316,675
22 yrs.	1,399,720	$17.27	$26,520,727

PRODUCTION OF LEAD ORE

Period	Tons	Period	Tons
1851–1859	2,500	1884	10,350
1860–1869	16,500	1885	11,225
1870–1875	23,700	1886	11,575
1876	6,776	1887	10,450
1877	8,911	1888	12,350
1878	9,625	1889	12,439
1879	12,320	1890	14,601
1880	11,694	1891	13,780
1881	12,127	1892	20,360
1882	11,980	1893	18,410
1883	9,240	1894	19,010

44 years, 279,923.

*Joplin, Mo.

Tapping Mine Water under Great Pressure

A Cased Drill Hole Will Discharge the Large Volume of Water into a Tail Drift and Thence into the Tunnel

BY ROBERT SIBLEY*

The Iron Mountain Tunnel Company has for more than two years been driving a tunnel to tap its mine near Superior, Mont. The mine was allowed to fill with water in 1905. The tunnel, which is more than a mile long, will reach the old workings during the present month, when the engineers expect to encounter 110,000,000 gal. of water under a head of 935 ft. A method for handling this enormous volume and pressure has been worked out by Robert Angus, the mine superintendent in charge.

In 1897, a law was passed by the Montana Legislature entitled, "An Act to Further Protect Underground Miners" and is in part as follows: "It is the duty of any person, company or corporation, who shall have sunk on any mine a vertical or incline shaft to a greater depth than 100 ft., and who shall have the top of such shaft or hoisting opening covered or inclosed by a shaft or building which is not fireproof, and who shall have drifted on or along the vein or veins thereof, a distance of 200 ft. or more, after crosscutting the same, and shall have commenced to stope, to provide and maintain to the hoisting shaft or the opening through which men are let into or out of the mine and the ore is extracted, a second escapement shaft, raise, or opening, or an underground opening or communication between every such mine and some other contiguous mine in all cases when necessary, or in cases of accident must be secured and kept in force." As the law required the State inspector of mines to see to its enforcement by severe penalties for non-compliance, a number of mines operating at a great depth and which did not have the escapement shaft referred to were forced to close down their workings.

In 1898, the inspector visited the properties of the Iron Mountain company situated near Superior, about 65 miles west of Missoula in what is known as the Cœur d' Alene mining district. In his written report he found things as shown in the illustration showing tunnel No. 7 which gave him considerable anxiety. The boiler house is located at one side of the portal of the tunnel and the compressor house at the other. The tunnel, shown in the illustration between these two buildings, is the intake for the air; after entering it descends into the mine and passing through the workings, finds an outlet through the old stopes to the surface. Should a fire have occurred in either of the buildings mentioned, the smoke and gases resulting therefrom would have undoubtedly followed the same course as described for the air and would probably have smothered every man in the mine.

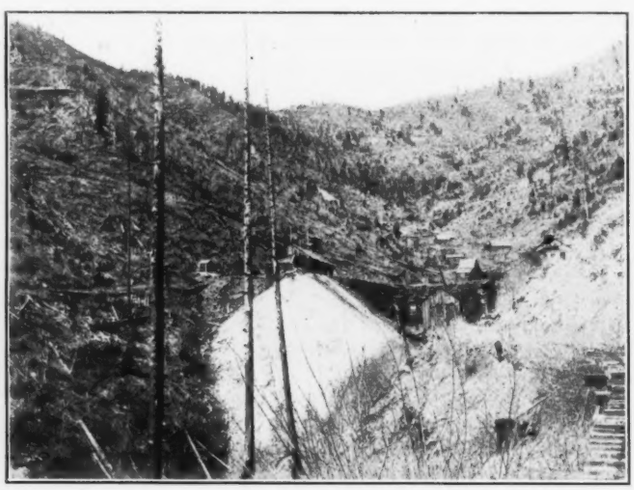
The owners of the mine were required to meet the conditions of the law just enacted by the legislature. Although originally raises had been driven connecting the levels in the downward development of the mine, they had been abandoned and allowed to close as the upper levels were worked out. In view of the facts that the panic of 1893 closed the doors of the banks in which the company had set aside 5 per cent. of its earnings for the purpose of driving a tunnel to tap the workings below, that the company had invested heavily in other properties which were not yet producing as much as had been anticipated, that the prices of silver and lead were low, and that it would require from six to eight months of shutdown at a loss of $150,000, to say nothing of the difficulties to be encountered in keeping the old shaft clear of water, the outlook was so discouraging that the old management preferred to close the mine.

The Iron Mountain Properties

The Iron Mountain mine was discovered in the latter part of 1888, and during the 10 years of its existence the company expended about $45,000 for the concentrator, boilerhouse, and other buildings and machinery. The patented territory is 89 acres of lode claims, 15 acres of mill sites and 100 acres of placer and 204 acres of unpatented ground, including seven unpatented lode claims which are held by location, each one of which shows a well defined quartz vein.

During a part of the history of the Iron Mountain company, the railroad which now runs within 3½ miles of the mine was not in existence, and the ore was hauled over a range of mountains, then loaded into flatboats on the Missoula river and floated down to Paradise station on the Northern Pacific railroad before it could be loaded on cars and started to the smelters. Notwithstanding all of these disadvantages, the amount expended for improvements in the way of roads, bridges and surface improvements, and

PLANT AT FOOT OF TRAMWAY



DUMP AND OLD TOWN OF PARDEE

*Hydraulic and electrical engineer, Missoula, Mont.

the extraordinary method of running, the mine paid during those years a total of $507,500 in dividends. The shoot of ore which was only about 70 ft. in length at the time of its discovery increased to 500 ft. when the 1750-ft. level was reached, it being continuous for the entire distance. Even this length of 500 ft. will doubtless be increased when the narrowing ends are still further prospected.

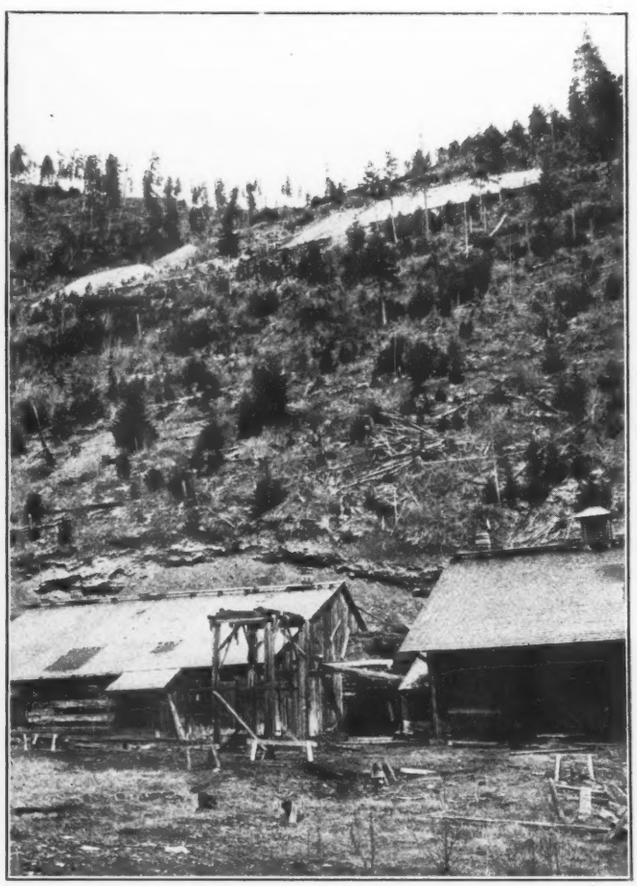
In February, 1906, the properties of the old Iron Mountain company were bought by a new company, the Iron Mountain Tunnel Company, organized by the following Montana citizens: Hiram Knowles, T. H. Burke, Henry Neill, F. C. Stoddard, C. F. Dorman, William B. Russell and William Q. Ranft. Mr. Ranft, vice-president of the corporation, has had under his direct supervision the general management of affairs since operations were resumed, while Hon. Marcus L. Hewett, one of the large stockholders, has had general supervision of the operations at the property.

During 1907 the Chicago, Milwaukee & St. Paul railroad, in extending its main line to Seattle, has built through the town of Superior, thus reducing by a mile the distance necessary to transport the ores when shipments are again undertaken, and more important, eliminating the expense of transferring the ores across the Missoula river to the town of Iron Mountain. The average of 52 assays of the ore gives 79.03 oz. silver per ton and 40.83 per cent. lead.

The Tunnel Project

The reorganized company has undertaken to tap the old workings at the 1600-ft. level. The old shaft is drained at the 700-ft. level by tunnel No. 7, which was driven by the old company. Below this point, however, there is no outlet whatever. As a consequence, the tunnel now being driven, when it reaches the old shaft, will tap a body of water estimated at 110,000,000 gal. under a head of 935 ft.

SURVEY LINE AND PORTAL OF TUNNEL



ENTRANCE TO TUNNEL NO. 7

The new tunnel is 7x6 ft. on a grade of 4 in. per 100 ft., and has a drainage flume 12x12 in. laid in the flooring. The work of driving the tunnel which is to be 5602 ft. long was begun Feb. 10, 1906. In October, 1906, it had been driven 1500 ft., and 4345 ft. had been excavated by September, 1907, leaving uncompleted a distance of 1255 ft. At the present writing 5570 ft. have been completed and it is estimated that the final tapping will take place about the 10th of March of the present year.

Excepting four stretches of ground, aggregating in all about 800 ft., the rock encountered was very hard, requiring a heavy expenditure of explosives. In the distance the tunnel has thus far been driven, it has been necessary to timber only 535 ft., the formation requiring support being encountered in four different places, one of them 325 ft. long. Up to the last six months the tunnel was found to be exceptionally dry, but since that time heavy flows of water have been encountered, so heavy that it was frequently almost impossible to keep the powder in the drill holes while loading preparatory to blasting, the water pressure tending to force the powder out. Much trouble was also caused by wet fuse. There was, of course, more or less difficulty in keeping full crews for each shift.

The accompanying profile map shows a number of different veins encountered in driving the tunnel. At a distance of 1900 ft. from a portal of the tunnel a vein was cut which showed a mineralized zone about 30 ft. wide. A crosscut was started at 2200 ft. in order to cut this same vein which it is estimated will be accomplished at a point nearly 500 ft. west from the point of intersection of the main tunnel. At the 3179-ft. mark a vein of white quartz-carrying copper was encountered. Several seams of talc of varying thickness and of different colors, some white, others of a very deep red, were cut; in the Cœur d'Alene district these talc seams are usually followed up and prospected, for

in many cases, they open up into large orebodies.

Speed and Cost

The company's expense account covering the cost of driving will be of great value in future operations of a similar character; through the courtesy of the officers of the company a summary is given in the accompanying table.

The black line shown to the left of the old shaft in the profile map is a zinc-silver-lead vein which is paralled to the original silver-lead vein extending its entire length and is still in its virgin state. This vein shows never less than 29 per cent. nor more than 31 per cent. zinc at each level with 8 per cent. lead and 12 to 15 oz. silver. The vein has an average width of 4 ft. The association of the zinc with the silver-lead ore is so close in this particular formation that no effort was made at the time the property was formerly operated to separate the minerals. This shoot is known to go down as far as the old workings, that is, as far as the 1750-ft. level.

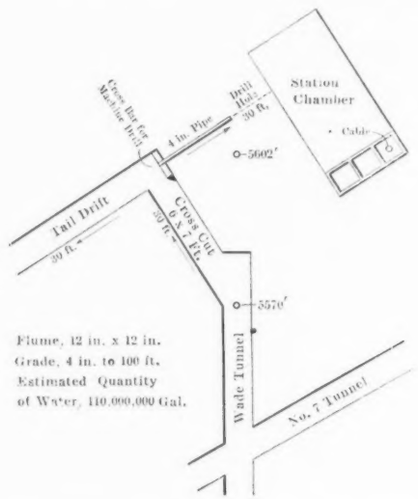
When the tunnel is completed the company purposes to extract the zinc-silver-lead ores, of which there is an estimated tonnage of 200,000 tons and, at the same time, to sink a shaft 250 ft. below the tunnel level and then crosscut and drive on the original silver-lead vein; this will give 100 ft. depth and 500 ft. length for stoping, since the old shaft is 150 ft. below the tunnel level. The entire length of the tunnel will be 5853 ft., the distance beyond the 5602-ft. point having been excavated by previous workings.

COST OF DRIVING IRON MOUNTAIN TUNNEL

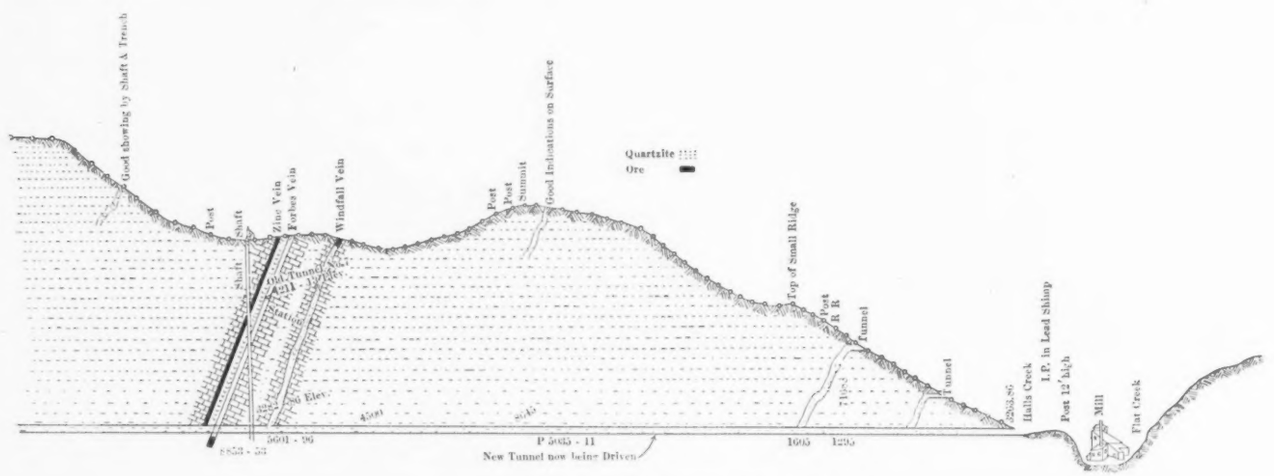
Time of Driving.	Feet.	Cost per Foot.			Feet Driven.	
		Gross.	Driving and Equipping.	Driving.	Side-track.	Cross-cuts.
Prior to June, 1906	559					
1906.						
June	231	$20.11	$18.70	$15.58		
July	215	14.81	11.81	11.01	40	
August	229	14.96	14.85	14.15		10
September	227	13.29	12.31	11.59	80	
October	285	12.95	12.59	11.80		
November	264	12.66	12.30	11.00	85	
December	260	15.77	15.36	13.39		9
1907						
January	288	12.08	11.79	10.64	100	4
February	267	12.09	11.76	10.69	60	
March	244	13.81	13.44	12.75	50	
April	251	13.03	12.68	11.53	70	
May	254	14.35	13.99	13.03	43	
June	251	13.37	13.00	11.88	50	
July	206	14.65	14.22	13.02	64	
August	228	18.11	17.67	16.27		
September	170	15.95	15.55	14.45	100	
Totals	4429	$231.99	$222.02	$202.78	742	23
Averages	233.1	14.50	13.88	12.67	46⅜	1⅞

Note: No report was made of costs per foot of the first three months' operation.

The peculiar engineering problem now before the Iron Mountain Tunnel Company is the big quantity of water and the high pressure to be dealt with when the old shaft is tapped. Robert Angus, the mine superintendent in charge has worked out a very ingenious method of attack which, it is thought, will obviate any serious risk to life or property, when the water begins to flow out. As shown in one of the illustrations, when the 5570-ft. point is reached in driving the tunnel (now only a few feet distant) a crosscut is to be run parallel to the old shaft or station chamber. This crosscut will be continued 30 ft. and at this point a 30-ft. tail drift will be driven at right angles to the crosscut. At the head of the tail drift which is 30 ft. from the station chamber a 2½-in. hole will be drilled to tap the station chamber. This hole will be cased with piping for 20 ft. and the piping thoroughly braced and cemented in. When the drill has reached within a few feet of the station chamber a "get-away" car will be provided for the miners. A heavy bracing will be provided for the machine drill, which in addition to the 100 lb. pressure from the compressed-air feed pipe will furnish more than 1000 lb. per sq.in. resistance to the 400 lb. hydraulic pressure in the station chamber. Drilling will then be continued until the hole is practically through when a fuse will be lighted just as the miners leave on the "get-away" car. This fuse will be connected with a charge of dynamite placed behind the bracing for



TAIL DRIFT AND DIRECTION OF DRILL HOLE



PROFILE, IRON MOUNTAIN TUNNEL, MILL TO MINE

the machine drill. The explosion will tear loose this bracing and the hydraulic pressure will force the long drill back into the tail drift, thus allowing the water to pour out after the miners are a safe distance away.

There are many conjectures as to just how the onrush of water will affect the workmen or the tunnel itself. It is certain that the tail drift will provide a means of breaking the tremendous force of the water and the 12x12-in. flume in the bottom of the tunnel which has a grade of 4 in. to the 100 ft. will be amply large to carry away all the water provided the tapping hole and its piped encasement remain intact. If the hole is 2½-in. in diameter, under a head of 935 ft. the water will flow out at a velocity in the neighborhood of 245 ft. per sec. or about 2¾ miles per minute. The quantity of water carried out per second will be about 8.37 cu.ft. or 5,410,000 gal. per day. It is estimated that 110,000,000 gal. of water are stored in the station chamber and the workings above. Hence it would take about 20 days to drain the reservoir provided the high velocity were maintained and no additional water entered from seepage. As the head will decrease in draining and considerable seepage water is to be expected it may be safe to say that 40 days in all will be required under normal conditions.

The flume line in the bottom of the tunnel is 12x10 in. in the clear and ought to have a carrying capacity of nearly 12 cu.ft. per second. This should carry away all the water flowing from the tapping hole and after the first few days the tunnel itself should be sufficiently drained to allow the workmen to proceed with development in other parts of the workings. Just how the whole affair will actually turn out remains to be seen. Progress is watched with great interest. A careful record of all stages of the operation will be kept.

The Gold Camp of Masonic

By H. Hunter*

Masonic is situated in Mono county, California, a few miles west of the Nevada-California line. The camp was discovered four years ago by three prospectors from Colorado, but no work was done until two years after the discovery.

The only property that has been developed in depth is the Pittsburg-Liberty mine. At this mine about 2000 ft. of development work has been done but it is developed to a depth of only 150 ft. The last shipment from this mine consisted of 17 tons, said to have assayed $1080 per ton. The company has completed a 10-stamp mill to treat the ore.

At several other properties in the district some work is being done; two adits have been started near the foot of Masonic mountain so as to develop several of the veins at depth.

On the Jump-Up-Joe property there is a large dike in which patches containing native gold can be seen.

It is rumored that a custom mill will be erected on the East fork of Walker river a few miles from the camp.

*Carson City, Nevada.

Rawhide, Nevada

By W. Fay Boericke*

Rawhide may be reached by three routes; either by railroad to Fallon and thence by automobile or stage a distance of 45 miles to the camp; by stage from Schurtz; or by automobile or stage from Mina. The latter is the best route, but is longer. The stage fare from Fallon and Schurtz is $10; the automobile fare from Fallon is $15. Travel at present is very heavy. Most of the miners have left Wonder, as many of the mines in that camp have temporarily closed down, and have gone to Rawhide. Since the strike a large number of miners from Goldfield have also gone to Rawhide. The population is over 1000.

The mineral belt approximately is 1½ miles long by 1¼ miles wide and runs north and south. The formation seems to be silicified rhyolite, altered by hydrothermal action; it is much broken. The later andesites appear on either side. A series of parallel dikes, along which there has been considerable silicification, run north and south through the mineral belt. As yet no well defined veins have been developed. Some phonolite has been found.

There is a considerable free gold, showing at surface in the cracks and crevasses. As yet there have been no veins worthy of the name opened up. The gold is usually found in plate form and is sometimes crystallized. Consequently it makes very pretty specimens. On account of this occurrence of the gold in the narrow cracks, a visitor characterized the work as "whisk broom and pan mining." Nevertheless, several shipments have been made (principally from the Balloon claim) that, the shippers state, yielded sensationally high returns; the camp has frequently been called "a second Goldfield."

Along the series of parallel dikes is found some silver ore; in some of this rock there are grains of stephanite, ruby silver, and silver chloride large enough to be recognized without the aid of a microscope. This silver ore is regarded as the more important, for the sensational gold showing may be only superficial.

Little work of a permanent character is being done. No large companies are at work and there is as yet little stock booming. Nearly every man is a leaser and without money to do deep mining. At present the ore must assay at least $100 per ton to be profitably mined.

Prices for some mining necessities are: lumber, $75 per thousand; water, $2.50 per bbl.; powder, 16c. per lb.; fuse, $1.25 per 100 ft.; coal, $75 per ton; hay, $60 per ton. Miners' wages vary from $5.50 to $6.50 per 8-hour shift. The charge for hauling ore to the railroad is $25 per ton.

The camp is having a big boom at present, and this is the more remarkable on account of the universal depression prevailing elsewhere throughout the State, especially so, when one considers the difficulty of getting money for working properties even in the well established camps. The absence of stock floations is also in strong contrast to the practice prevalent regarding boom camps in Nevada two years ago.

*Berkeley, Cal.

British Metal Imports and Exports

Imports and exports of metals in Great Britain for the month of January, 1908:

	Imports.	Exports.	Balance.
Copper:			
Copper ore	7,173	.....	.....
Matte and precipitate	6,524	.....	.....
Fine copper	8,233	.....	.....
Total copper	12,212	4,211	Imp. 8,001
Total, 1907	10,352	4,543	Imp. 5,809
Tin:			
Straits	2,664	.....	.....
Other	717	.....	.....
Total	3,381	2,371	Imp. 1,010
Total, 1907	3,874	2,126	Imp. 1,748
Lead:			
United States	2,696	.....	.....
Spain	7,736	.....	.....
Other	8,602	.....	.....
Total	19,034	4,055	Imp. 14,979
Total, 1907	18,868	4,524	Imp. 14,344
Spelter:			
Spelter	6,601	.....	.....
Sheets, etc.	1,063	.....	.....
Total	7,664	309	Imp. 7,355
Total, 1907	10,278	459	Imp. 9,819
Quicksilver, lb.	28,148	234,055	Exp. 205,907
Quicksilver, 1907	18,375	264,525	Exp. 246,150

Figures in long tons, except quicksilver, which is in pounds. Copper totals give estimated contents of all material in fine copper. Tin ore imports, not given above, were 1995 tons in 1907 and 2005 tons this year.

The typical unoxidized ore, at Goldfield, as it occurs in the dacite consists, according to F. S. Ramsome (*Economic Geology*), of pyrite, bismuthinite and a reddish-gray cupriferous mineral having the general composition of tetrahedrite. Native gold is associated especially with the bismuthinite and pyrite and can be readily seen in the richer ore. The copper mineral, designated tetrahedrite, contains antimony and sulphur and is therefore not bornite, as it is called in the district. The native gold is often so finely divided that, when panned, the ores leave a streak of yellow ocher behind the black sand. The amount of silver in the ore is small.

Metallics

Fish-plates are seldom used to connect rails underground. Their use is to be recommended on all main tracks, for it reduces the chances of cars being derailed by poor joints, due either to poor spiking originally or to the working loose of spikes that have split the ties.

The zinc shavings used at the Portland mill in the Cripple Creek district, of Colorado, are made by cutting, at one time, a bundle of 20 sheets of M. & H. No. 9 zinc, rolled upon a 6-in. mandrel of an ordinary lathe. One man cuts from 350 to 450 lb. of shavings in eight hours.

The zinc shavings used in the precipitation boxes at the Portland mill in the Cripple Creek district, Colorado, are dipped in 2 per cent. lead acetate solution before use. In the boxes 14-mesh screen is used for the trays. In the clean-up all zinc staying on a 4-mesh screen is returned to the trays.

When lead acetate is added directly to the cyanide solutions in the zinc boxes it is better to allow it to drip into only the rear boxes as thus the amount of bullion contaminated with lead is decreased. By cleaning up these boxes separately from the others, the bulk of the precipitate can be kept fairly free from lead.

Ice in shafts should be frequently cut away, not only on account of the danger of the breaking off of the icicles and their falling through the shaft, but also because the ice gradually reduces the effective ventilating area of the shaft and so decreases the supply of air, which at most metal mines is too small even under the best conditions.

The mining method is often influenced by the labor obtainable. This is especially the case on the Rand, where owing to the inability of the Kafir to learn, or rather the refusal to try to learn, to drill up holes has caused the adoption of underhand stoping. This is the one important field where underhand stoping is used more than overhand stoping.

Heating the cyanide solutions by exhaust steam has been found at the Witwatersrand Deep mill, in the Transvaal, South Africa, to increase greatly the rapidity with which the slimes settle and also to increase the gold extraction. In summer the solutions are heated from a temperature of 70 deg. F. to 85 deg. F.

The working costs of the Knights Deep mine on the Rand, South Africa, for the quarter ending Jan. 1, were 17s. 10.7d., or $4.29 per ton; mining costs were 8s. 11d., or $2.14 per ton; milling and cyanidation costs, 3s. 2½d., or 77c. per ton. The cost of milling and cyanidation was subdivided as follows: Milling, 1s. 4.7d., or 33.4c.; tube-milling, 6.1d., or 12.2c.; cyaniding, 1s. 0.3d., or 24.6c.; and slime expenses, 3.4d., or 6.8c.

The orebodies at Rossland are irregular in size and extent. This causes the expense of exploration and development to be high in proportion to the cost of extracting the ore. The cost of mining at the Le Roi mine, for the year ending June 30, 1907, was $3 per ton. The cost of exploration and development is calculated at 84c. per ton. The cost of raising is given as $42 per ft.; of sinking winzes, $41.34 per ft.; of driving crosscuts, $14.88 per ft.; and of drifting, $15.71 per foot.

A wire rope that is to be used in a shaft, the top part of which is vertical and the bottom inclined, should be ordered considerably longer than a rope to be used in a vertical shaft of the same length The beating against the rollers at the bend in the shaft wears the hoisting rope rapidly. This wearing is greatest near the skip at the point where the rope becomes tangent to the rollers during lowering. Therefore, on account of this wear, the cable has to be re-capped more frequently than is generally the case in a vertical shaft and, besides, the length that must be cut off each time is longer.

A down-cast shaft should be frequently inspected in the winter, no matter how smooth the cages run through it during hoisting. Frequently icicles form in the shaft and these must be chopped away so that the jar of the cage will not break them off and cause them to fall through the shaft, possibly causing, as was recently the case at the Stanton mine, Wilkes-Barre, Penn., a fatal accident. It is best, if possible, to make a wet shaft an upcast on account of this trouble with ice in the winter. This can be done sometimes by turning the exhaust from an underground pump or hoist upward in the shaft, or by erecting in the headframe a box continuation of the pump compartment.

Tin is refined in two ways, by poling and by liquation. As the poling of tin is carried on at a low temperature, the action of the gases from the burning wood differs from copper poling, for in that process the gases are strongly reducing in action. In the refining of tin by poling, the impurities are removed mainly by the agitation of the mass by the escaping gases; this agitation enables the impurities to separate from the mass of tin and come to the surface as a scum, composed mainly of oxides of tin and other metals. Liquation is the most commonly used method for refining tin. Liquation alone is used in Saxony and Bohemia; in Cornwall, a combined poling and liquation method is used.

At the Portland mill, in the Cripple Creek district of Colorado, the strength of the strong solution is 0.6 lb. cyanide per ton of solution and the protective alkalinity 0.6 to 1 lb.; the strength of the weak solution is 0.3 to 0.4 lb. cyanide and the protective alkalinity, neutral to 0.3 lb. The gold content of the strong solution is 20 to 40c. per ton, while that of the weak solution is 10 to 20c. The gold is precipitated on zinc shavings. The solutions, after passing through the zinc boxes contain only a trace to 4c. per ton, at the most. A white precipitate, consisting of calcium ferro-cyanide, zinc hydrate, calcium sulphate, calcium carbonate and fine slime from the sand filters, forms more copiously on the head boxes of the weak-solution side than in those of the strong-solution side, although the strong solution is stronger than the weak in calcium salts.

Daily sampling of the ore in the stopes is important at mines where the value of the ore cannot readily be judged from its appearance. With lead, copper, zinc and silver ores, generally the appearance of the ore is a good indication of its value. But at gold mines it is frequently difficult to judge of the value of the ore from its appearance. In such cases the cost of mining depends much upon the amount of waste broken down needlessly in mining the ore. In such ores close sampling is good policy. This sampling should be done by trained samplers. The shift-boss should not be required to do the sampling because he has other important duties, which should occupy too much of his time to allow him to do the sampling properly. Samplers in time gain great dexterity in the work, and soon learn the characteristics of the orebodies. Grab samples such as most shift-bosses take are poor samples. If sampling is worth doing, it is worth doing well.

In the fire assay of gold and silver the temperature at which cupellation is done is important, for the loss of gold and silver, due to absorption by the cupel and also to volatilization, increases rapidly with the temperature. Rose states that lead melts at 326 deg. C. and uncovers at 675 deg. C.; and that litharge freezes at 640 deg. C. Rose recommends that the air in the muffle be kept at 700 deg. C., although the temperature is too high for feathered litharge to form. Lodge recommends 625 to 775 deg. C. as the proper range of temperatures for cupellation and states that feathers of litharge ought to form on the cupel. Lodge states that litharge crystals form at a temperature varying from 625 to 800 or 825 deg. C. As a result of recent experiments, C. A. Fulton recommends that a muffle temperature of at least 800 deg. C. be used to start cupellation, lowered to about 770 deg. C. during the greater part of the oxidation period, and finally at the finish raised to about 830 deg. C. in order to obtain a pure silver button. As the actual temperature of the lead is always higher than that of the muffle, this finishing temperature of the lead itself should be about 910 deg. C. He also states that it is as important to regulate the air drafts, during cupellation, as the temperature.

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**Illustrated.*

The German Zinc Convention

The convention among the producers of spelter in Germany, which was consummated in February, is not the first arrangement of this kind. In 1879 and 1882 syndicates to control production and price were organized in Europe, but their efforts were of only temporary effect on the market, which continued to sag under the weight of the heavy production going on at that time. In 1888 there was formed a combination of the French, German and British producers to restrict production which went into effect in 1889 and continued to the end of 1894. This was probably the best sustained effort to regulate the price of spelter in Europe, but although it had a temporary influence on the market it could not prevent production by new concerns, who were led into the business by the attraction of high prices and large profits, and its ends were thus defeated.

The recently formed convention was apparently inspired by alarm over the increasing capacity for spelter production, both on the part of the old producers, and also on the part of new concerns contemplating entrance into the business. The convention recently formed comprises only the German producers, and lacks one of them, namely Giesche's Erben, an important Silesian producer. The absence of that concern, however, is understood to be rather a matter of principle against entering into a formal alliance than a manifestation of opposition to the plan, inasmuch as it is understood to have expressed a willingness to fix an amount for its production and to adopt the prices determined upon by the syndicate. The syndicate is to extend for three years, and comprises not only the smelters, but also the great metal houses which are prominent in the sale of the product. Under the agreement, these houses are to have the disposition of the whole product. Consequently, the present convention differs essentially from the previous ones, inasmuch as they aimed merely to regulate production, while now it is contemplated not only to regulate production, but also to govern the marketing of the metal, which involves some control over the matter of price.

It will be interesting to observe how this scheme will work out. There is no reason to anticipate any such arbitrary attempt to controvert the law of supply and demand as has been tried by some American trusts, inasmuch as the houses which will sell the product are experienced traders and have the trader's instinct to keep their commodity moving. Consequently, it is to be expected that the syndicate will assume a conciliatory attitude, on the one hand restraining the producers from making excessive outputs, and on the other hand making prices to the consumers that will not restrict their business activity. Nevertheless, there is danger, even in such a benevolent policy, as recent experience in America has amply demonstrated. It is difficult for the human mind to play successfully the part of Providence.

Of course, the German syndicate alone will not occupy a commanding position in the European market, but its organization is merely a step toward an international convention, in which it is expected that the Belgian, French, and British producers will enter.

Membership in Technical Societies

We received recently the following letter: "I have been requested to join the ——— ——— Society. I know that it is a technical organization of high standing, but its purposes are rather outside of my distinct field of interest, which is mining engineering, and being only a beginner in the practice of my profession, my income is not yet so large that annual dues to technical societies is a matter of no consideration. However, I have been urged to join the ——— ——— Society by a friend, particularly interested in it, whom I am anxious to oblige. I should like to have your advice as to how much advantage it would be to me."

The above letter may well serve as a text for a discussion of the general subject of engineering and technical societies, wherefore we have blanked the name of the particular society to which our correspondent referred. We will remark only that it is one of the smaller technical societies, but one which aims to serve a highly meritorious purpose, and is conducted by a management which has high ideals. It is a society which should by all means be joined by everyone who is

interested directly in its particular subject.

However, the question of membership in engineering and technical societies is becoming rather troublesome, not only to the junior members of the profession, whose resources are comparatively small, but also to the older men, whose resources are sufficiently liberal. During the last 10 years, the number of American technical societies has multiplied largely. A few enthusiasts who are interested in some particular line of scientific or technical work come to feel that the interests of their specialty will be promoted if they be fathered by an organization, get together some day to talk over the matter, and a new society is born. Then, naturally, an effort must be made to secure a sufficient membership to carry it on properly, which leads to solicitation among personal friends, who may have only a mild interest in the matter, or no interest at all, but eventually are inveigled into joining. Certainly no great fault is to be found with this, except that a person invited to join, who does not really want to, often feels embarrassed about declining; while others, who join because they feel they may derive a little benefit, have to pay more for it than they would for the same thing obtainable in another way.

The practice of another class of scientific societies is more open to criticism. We receive in the mail a typewritten letter saying, "You have been elected to (or proposed for) membership in the So-and-So Society. A blank form is herewith inclosed for your signature." The letter then goes on to say that the annual dues are $2, $3 or $5, as the case may be, and members receive the ——— magazine, which is the official organ of the society. These societies are nothing more than organized subscription lists, and the election to membership, or proposal for membership, is nothing more than the manifestation of the efforts of the circulation manager. They are put in such a way that they require a polite letter of declination. The practice is a lowering of the value of the names of some good societies.

Reverting to the inquiry of our correspondent, we think that every American mining engineer in good standing should be a member of the American Institute of Mining Engineers, because that is the national organization of the profession. That is the natural choice for anyone who is able to be a member of only one society, and every young mining engineer should join it at the earliest possible time. In that way, he identifies himself with the organized profession and obtains various material advantages which are well worth the initiation fee and annual dues. When it is felt that benefit will be derived from membership in some special society, if electrometallurgy is the special interest of the young engineer he will naturally join the American Electrochemical Society, or in the case of general chemistry, the American Chemical Society; or some of the excellent local societies like the Lake Superior Mining Institute.

However, nobody need feel any hesitation about declining membership in any society in which he has no particular interest. None of the American technical societies, with the exception of the American Society of Civil Engineers and a few others, has any special requirement for membership other than a good personal reputation, and some interest in, or identification with, the purposes of the society. Consequently membership in these societies does not add to professional distinction, although it may be properly argued that if anyone is not a member of the leading society of his particular profession, if, for example, a mining engineer in this country is not a member of the American Institute of Mining Engineers, such a person is lacking in professional interest.

The Diamond Market

The industrial depression, which is most severe in the United States, but also is in evidence in Europe, is bringing perplexity to another trust, that had thought to control the market price of its product and up to the present time has done so successfully. Nowadays, people have not much money to spare for diamonds, and the hard times have practically put a stop to the sale of new stones. The trust is finding much difficulty in maintaining its price. It is said to have been obliged to buy old stones in the market in order to prevent utter collapse, many owners of jewels having been trying to realize upon them. Nevertheless, the combination, like Ajax defying the lightning, keeps up its output in South Africa and continues to declare that it will maintain prices, though it is rumored that the Premier company may before long withdraw from its combination with the De Beers.

The Mineral Production of Canada

The mineral production of Canada again shows a gratifying increase, the total value reported for 1907 having been $86,183,477, which compares with $79,057,308 in 1906, and $69,525,170 in 1905. The increase last year was made notwithstanding a decrease in the gold output, that of the Yukon having been only $3,150,000; while British Columbia also showed a decrease. The loss in gold was much more than offset by large gains in coal, pig iron, silver, nickel, asbestos and petroleum; while cement and other materials of construction increased largely. The relative proportion of the more important minerals and metals is shown by the statement that coal furnished 28.5 per cent. of the total values; copper, 13.3; nickel, 11.1; silver, 9.7; gold, 9.6; lead, 2.9 and asbestos, 2.9 per cent.

The two products in which Canada is an especially prominent factor in the world's supply—nickel and asbestos—both show a gratifying increase. Silver also gained largely, on account of the activity in the Cobalt district. The large increases in coal and iron indicate general industrial activity.

In Canada, as in this country, financial conditions tended to restrict activity in the last quarter of the year. The financial crisis, however, was much less severely felt in that country than in the United States, and in most cases stoppages of production were limited and temporary in their nature. The fall in prices of metals will continue to be felt, of course, but there has been little restriction in the home demand—very much less, indeed, than on this side of the border.

The remarkable growth of Canadian mineral production is shown by the fact that the total value last year was more than three times that reported in 1897, only 10 years ago; and nearly eight times that of 20 years ago, in 1887. During this period Canada has changed from a country almost purely agricultural to one

with great mining and manufacturing interests; and the mining industry especially is making extraordinary advances.

Pyritic Smelting

The exceedingly instructive series of letters on pyritic smelting, that recently appeared in the JOURNAL, shows how difficult it may be to make theory fit practice after practice has taken the lead and is shaping its own course. Here is an apparently simple process, based upon a principle which is fairly well understood, the combustion of sulphur and iron instead of carbon; and yet the opinions of skilled operators concerning the *modus operandi* are amazing in their diversity. One metallurgist told the story of a case in which the process did not prove successful, and the reasons for the failure as given by metallurgists of experience and reputation are as different as different can be. One shows by means of carefully constructed formulas that the proportion of coke in the charge was too large; another, by a line of reasoning equally convincing, that the furnace needed more carbon. One ascribes failure to the lack of silica, another to the use of cold blast, and so on through a perfect kaleidoscope of differing views.

Pyritic smelting has always been the most erratic of metallurgical processes. It chooses its own slag, in contempt of the careful calculations of the chemist; sometimes it succeeds and sometimes it does not. Anyway, it is one of the most attractive of metallurgical operations. It combines roasting and matting, and instead of requiring carbonaceous fuel for each, utilizes waste elements in the ore to furnish heat for both. A vast amount of study has been given to the intricacies of the process, but the behavior of the various elements is not yet fully understood.

It is, of course, easy to find reasons for the uncertainty of the pyritic smelting process and the diversity of opinions concerning its causes. The composition of the charge is within easy control, but another factor which determines the behavior of the elements, namely, the rate of combustion, is a matter which no one can, as yet, govern or predict. The time element governs not only the temperature of the furnace, but also the distribution of the heat and the action of the complex mixture of chemical elements which usually make up the pyritic charge.

One of the suggestive views, presented in the recent series of letters, concerns the importance of the physical condition of the pyrites in the charge and the size of the mineral particles with especial reference to the surface presented to the oxidizing action of the blast. It is, of course, impossible to control the distribution of the various minerals in a lump of ore, but it is possible to control the size of the lump.

Snares for the Unwary

The present time is unpropitious for company promotions, but the subterranean schemes to fleece the unwary are still prosecuted. Like the poor, they are always with us. The New Jersey Mineral Company, made the subject of a post-office fraud order, bobs up again as the Sussex Calcite Company, which is promptly knocked out by another fraud order. But the fraudulent promotions that come under the attention of the Post Office Department are only a fraction of those which fatten upon the gullible public.

Insufficient attention has been directed to one of the evil methods of these bunco steerers. This is their newspaper publicity departments, which aim to, and to some extent secure, the publication of misleading news in the columns of the regular press. There are numerous agencies which undertake the dissemination of such news, sending their typewritten reports gratuitously to the reputable papers. Of course, in most cases, the passage of these documents to the waste-basket is swift and unerring, but occasionally some items find their way into non-professional journals. The agents are naturally cunning in concealing the joker. There will be items of news respecting the Homestake, Anaconda, Copper Queen and other companies that everyone knows to be sound and important enterprises, and interspersed therewith will be the purposeful news about concerns, which to the uninformed appear by association to be the peers of the others. The local newspapers also are often "fixed." Consequently it behooves the investor to be careful about believing what he reads.

Another source of mischief is the reports and letters of advice which are published by brokerage houses. These range from bare-faced extolment of promotions in which the firm is directly interested, to the apparently disinterested reports respecting well known mining companies, listed on the Stock Exchange or traded in on the curb, to which it is desired to attract the attention of the public. A little reflection shows the reader how destitute of authority is most of this information. All of these things are traps for the unwary.

As to the unquestionably fraudulent promotions, which are subject to exclusion from the United States mails, the remedy is quite simple. Those things cannot exist when the service of the mails is refused. The Post Office Department returns letters with the stamp of "Fraudulent," as soon as it is convinced of the fact. It is only necessary for some public-spirited citizen to call its attention to the matter, as H. S. Wardner did in the case of the New Jersey Mineral Company. Sometimes promotors endeavor to keep the people living near the alleged mine ignorant of what they are doing toward raising money from the "investors," but it is next to impossible to keep the secret absolutely.

THE MEETING OF the Canadian Mining Institute in Ottawa last week was a very successful one in point of attendance, of the number and quality of papers presented and of the discussions of those papers. The business, outside of technical questions, also, was of some importance and was well handled; for the Institute, besides its technical side, acts as an adviser to the Government with much influence on all matters relating to the mining industries of the Dominion.

The old feeling of rivalry between Ontario and Quebec—or rather between Toronto and Montreal—developed to some extent at this meeting, but was fortunately settled. The unanimous election of a president from Ontario was largely due to the high estimation felt for Prof. W. G. Miller by all parties.

THERE SEEMS TO BE a perceptible improvement in the status of domestic business. Manufacturers and traders are looking more hopefully toward the future. An encouraging sign is the report of the American Car Association for February, which for the first time in many months shows no increase in the number of idle freight cars.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

Functions of the Consulting Mining Engineer

The excellent article by A. H. Rogers, in the JOURNAL of Feb. 8, supplemented by editorial comments in an earlier issue, affords texts for the following remarks. To me these also appear timely in view of the incipient organization of a guild of mining and metallurgical engineers, whose avowed purpose is to work for a better understanding of the mining engineer's work, and to afford better means of protection from the operations of incompetents masquerading in the guise of engineers.

Objection may be raised to the statements of Mr. Rogers that, "It is rare that the consulting mining engineer is called on for any service other than the examination and valuation of mining property for prospective purchasers," and that "vendors of mines do not, as a rule, call upon the consulting engineer for a report on the basis of which to present their property." I take no exception to his assertion that the reports "commonly presented (by vendors) are worthless in that they fail to give much important information, etc."; but I believe the experience of the majority of trained consulting engineers will attest the frequent and customary demand upon them for reports to serve as introductory means of enlisting the attention of capital to mining enterprises. This arises from the persistent attitude of large investors, who demand such reports as preliminary features of all important negotiations.

That the making of reports of this character by the most competent consulting engineers has been somewhat rare, and that it is more commonly for the purchaser that the engineer acts, is not to be gainsaid; but the reasons therefor are more remote. In the first place, the average vendor who meets the intending purchaser and who negotiates sales, is not the owner of the property, but a promoting middleman whose sole interests lie in securing a commission. This individual (often a series of individuals), unlike the examining engineer, is mostly concerned in optimistic advertising, and he is rarely able or willing to expend adequately in obtaining such reliable information as a sensible purchaser must needs acquire. Consequently the promoter seeks by various means to acquire reports which can be had at moderate cost, with the most glowing estimates of production. The really capable and conscientious engineer does act in the interest of the purchaser, because he cannot be used to trim his conclusions to anything but the true business conditions as they exist.

Colored Reports

Now, promoters of experience are very well aware of the character of the reports which they may expect from reputable engineers, and they do often require just this kind of service in order to get the attention of investors who know their own business well enough to demand something which is trustworthy. But, because the aggregate collection of very small sums from the many is often profitable and responsibility more readily shifted, a great volume of quasi-mine promotion is carried on by shysters, who certainly have no earthly use for an honestly built report. Even these, feeling the need of an engineer's support, resort to various subterfuges to obtain the services of well-known professional men. That they seldom have reports from such to show only proves that the profession is not to blame for the prevalence of charlatanism. Failing in efforts to get endorsement from competent engineers, the unscrupulous boosters of mining stocks (frequently also self-deceived enthusiasts) have recourse to one who will meet their unprofessional terms, supplying the lack of merit in the report by fulsome praise of the perpetrator, as "one of the greatest engineers in the country," etc.

American and English Practice

Mr. Rogers does good service in outlining the scope of work undertaken by consulting mining engineers, for the benefit of those who do not fully appreciate what they might secure at moderate outlay. But I think he errs in his comparison of English and American practice. Having had wide experience with both, there appears to me very little difference in reality, although the titles used might perhaps convey a different impression. The English largely use the term, "mine manager," as the cognomen for an officer who would in this country be styled "foreman" or "superintendent," according to the breadth of his authority.

In both countries, the difficulty of the consulting engineer's position arises from the false premises which Mr. Rogers very clearly indicates. To save initial outlay, mining companies, in dealing with the consulting engineer, commonly commit one of two blunders. If they employ him as general adviser, solely for consultation, they are apt to be negligent in acting upon his advice. If he is to be put in the position of non-resident manager, they often overlook the conditions essential to his success. On this account, many proposed engagements of this kind are declined by American engineers, both from foreign and domestic clients. English companies are especially prone to ask incongruous service from American engineers.

Place Responsibility Where it Belongs

This leads to a very important consideration in the engineer's contract with his employer. There is a principle upon which every competent engineer will insist, if he values his reputation and the success of his undertaking. This is the placing of all responsibility exactly where it belongs. Acting in either of the capacities named and more fully depicted by Mr. Rogers, there are elements of uncertainty in any mining operation, which are wholly outside of the scope of the engineer, and for which he cannot justly be held responsible, whatever may be the outcome of the enterprise. Lack of necessary funds, inadequacy of mineral resources, defects of title, litigation and other inherent complications may present obstacles insurmountable by any amount of precaution or genius for doing things. Again, the failure of employers to render effective the advice of the engineer effectually absolves the latter for responsibility in the results.

Directors should be made to understand clearly that the retaining of an engineer for consultation, even if the contract call for periodical visits to the property, does not charge the officer with responsibility beyond the character of his advice. That is to say, any untoward results arising from inefficient application of instructions cannot be justly laid at the door of the adviser who has no opportunity to enforce his instructions. Instances there are in which companies employing such advisers at the reduced rates of compensation which such connection implies, have endeavored to lay the blame upon the engineer when the mine employees failed to act upon his suggestions.

Advising or Managing Engineer

There are two distinct offices to be filled by consulting engineers, viz., inspector (adviser), and supervisor (manager). In the former capacity, no experienced engineer would do more than to

express opinions, without giving instructions, however urgently he might present his views. He is, in such case, acting as the board's attorney and counselor. As non-resident, or resident manager, no capable engineer can afford to accept responsibility without supreme authority within the limits of his jurisdiction, and this, as in other business fields, carries with it the right and duty of selecting his own assistants. What the public most needs to remember is that, as inspector (adviser) merely, with a superintendent or manager under direct authority of the board, the engineer cannot be held accountable for conditions and results, except in so far as his advice has been closely followed. To protect himself, the knowing incumbent will always make sure to have his advice committed to writing, retaining copies in his possession.

The Element of Chance

Mr. Rogers is decidedly right in enjoining small companies to "turn the technical management over to some well qualified consulting mining engineer." This conclusion has also been reached by a goodly number of clients, but too often only after it is too late to recoup the heavy outlays incurred through incompetent management. Here is undoubtedly a very efficient remedy for these conditions; but can the average investor be taught to apply it in his own case without the untoward experience which is the usual concomitant? There is necessity for going back of this error, to the mistake of original investment without consultation with a trained and absolutely unbiased engineer.

And what must be the final judgment of a disinterested onlooker? Verily it is you, Mr. Mining Engineer, who must shoulder a part of the blame. For where is now the means afforded to the moderate investor of making sure that he is employing one competent and trustworthy? In every other line there are penalties for quackery, and adequate provision for learning who are and who are not capable and efficient. To this extent, at least, it is the plain duty of the profession to be moving for its own protection, and for the enlightenment of such as honestly wish to invest in mining enterprises as a business, and not as a game of chance. We can never eliminate the gamester class of parasites, but we may do much more than we have yet done to point out the antidote therefor. Half the present misunderstanding will be obviated when means have been provided for properly placing the qualifications of individual American engineers before investors abroad and at home.

Plan for Small Investors

When small investors learn to fortify themselves with reports from engineers outside the employ of interested vendors, and also learn how to get unbiased information, the occupation of the mining gamblers will be largely destroyed. What is now needed is not so much an accredited list of capable engineers (valuable as this may be, if adequately gleaned), as some means of acquiring reliable information at moderate cost to small investors. This may be accomplished through clubbing arrangements by a group of individuals, or a plan which I have devised for some of my clients may perhaps be acceptable to other engineers as well.

Almost every mining engineer whose business calls him frequently into the field acquires a fund of information concerning a wide range of companies and properties. And even where his actual knowledge is incomplete, his experienced judgment should be valuable as regards the chances involved in the enterprise, basing calculations upon such information as is contained or withheld in the literature submitted by the vendors. For such service, a charge is made averaging not more than the usual fee for an hour's consultation, varying according to the amount of time required to consider and reply to the questions raised. I have found, as a general result of this class of practice, that a large majority of the applications have been satisfactorily answered. Where it is impossible to do this, the schemes in view are almost invariably unsafe, to say the least. The plan here suggested is an effectual preventive of the waste of an engineer's valuable time, which often arises from desultory consultation with those who do not understand or appreciate the service rendered.

There are many such matters not now sufficiently engrafted upon engineering practice, which the organizers of the new association believe important enough to merit such attention as may result in a better adjustment of the relations of clients and engineers. Architects, civil and mechanical engineers have done much to accomplish this in their own branches of the profession; but mining engineers have heretofore been delinquent in making evident the proper functions of the members of their craft, including the responsible relations of the consulting engineer.

Theo. B. Comstock.

Los Angeles, Cal., March 3, 1908.

The Copper Belt of California

In the Journal of Feb. 22, Herbert Lang replies to my letter of Jan. 25 criticizing his articles on "The Copper Belt of California," which appeared in November.

The severity of my letter was not, as Mr. Lang assumes, solely owing to his remissness in not crediting me with the results of my work on the Copper Belt, but because he has indirectly charged me with having constructed a defective plant, when in describing the new plant at Copperopolis in speaking of the reverberatory furnace he said: "This is now quiescent for reasons unknown to me, but supposedly connected with some difficulty of ore reduction." In his last letter he repeats this offence by again supposing that the matter of producing saleable ingot copper at Copperopolis had not been considered. The facts are that the plans of the new works at Copperopolis contemplated the production of ingot or wire bars. Again in this letter Mr. Lang supposes and assumes that ingot copper can be sold on the Pacific coast in quantity for 2 to 3c. per pound more than in New York. Had he investigated the subject of copper consumption in San Francisco he would have discovered that ingot copper cannot be sold in quantity there for 2 to 3c. above New York quotations, but that if sold under existing conditions it would have to be sold for 2 to 3c. less than New York quotations.

Mr. Lang charges me with lack of care in reading his article and of falling into the mistake of supposing that he prognosticated the giving out of the Belt mines with moderate depth. It is unfortunate that he wrote his article so that it could be so easily misunderstood; John A. Reed, in his article in the Journal of Feb. 22, on the same subject, understands the statement as I did, and as did also the objecting capitalist who has already appeared on the Belt and quoted Mr. Lang as authority for the statement that the copper mines of the Belt do not go down.

Furthermore, seeking investors have stated their fears that the ores of Copperopolis are difficult to reduce, their authority being Mr. Lang's article on the Copper Belt of California. He has, although unintentionally, I am sure, done the Belt harm, and has made statements in his article that are unjust and misleading. The exasperating feature in the matter is, that he did not take the trouble to ask for the facts, for he could easily have secured them, as he is well and favorably known on the Pacific coast and along the Copper Belt.

The errors in Mr. Lang's geology of the Belt ought to have been avoided, for some months before his article appeared, there was published in the "Geology of California," A. Knopf's "Notes on the Foothill Copper Belt," and in "Economic Geology," Vol. 2, No. 4, of June, 1907, John A. Reed's article on "The Ore Deposits of Copperopolis."

G. McM. Ross.

Stockton, Cal., Feb. 29, 1908.

The number of men engaged in mining in the Transvaal during the year ending June 30, 1907, was, white, 18,921; colored, 122,017; Chinese, 53,062; total, 194,000.

New Publications

"Exploitation du Petrole." By L. C. Tassart. Pp. 726; illustrated, 5¼x8 in.; cloth, $2. 50. Paris, France, 1908: Dunod & Pinat.

This handsome volume treats successively the ancient history of the petroleum industry; the various methods of winning the crude oil by digging and boring; its geographical and geological distribution in America (the Appalachian, the Ohio and Indiana, the Kansas and Oklahoma, the Texas and Louisiana, the California, the Colorado, and other fields of the United States, together with those of Canada and Nova Scotia, the West Indies and South America); Europe (Austro-Hungary, Roumania, France, the German Empire, Italy, Great Britain, Turkey and Russia); Asia (Persia, Mesopotamia, India, etc.); Africa and Australasia; methods of exploration and exploitation; chemistry of the petroleum products; physical and chemical properties of crude petroleums; and theories of the origin of petroleum. In a final chapter, the various hypotheses of organic and inorganic origin are critically considered, without the attempt to pronounce any one of them comprehensively satisfactory; and a very interesting question, namely, that of the influence of these theories upon explorations for petroleum and their reasonable prospects.

As a critic, M. Tassart apparently confines himself to the quotation of authorities on both sides, but from his own standpoint as an engineer, experienced in the exploration and development of oil-bearing territory, he perceives and states forcibly the bearing of theoretical considerations upon such enterprises, and is inclined, perhaps, to favor those genetic speculations which are most encouraging to practical adventures. For instance, he remarks in his Preface (p. vi):

"We shall see that some of these theories permit us to concede that petroleum is still forming in our time, so that, if they should be confirmed, petroleum (quite contrary to coal, the reserves of which are limited) would be a fuel competent to supply the needs of the future, though requiring to be reached by explorations of increasing difficulty, as its superficial deposits became exhausted."

And, in his final chapter, he draws from the inorganic theories the conclusion (not so strongly favored by the organic theories) that borings for oil should be continued to the greatest practicable depths at which permeable strata may possibly occur, instead of being stopped arbitrarily at a given geological horizon.

In consonance with this optimistic feeling, Mr. Tassart includes among the actual or possible petroleum districts of the world all those regions in which bitumen occurs.

Much of the information here brought together has been published eleswhere, in the English language; but there is a good deal which has been compiled from personal notes or authorities not accessible to the general student, and the value of such a summary, intelligently made and furnished with maps and drawings, is beyond question.

R. W. Raymond.

"The Metallurgy of Iron and Steel." By Bradley Stoughton. Pp. 509; illustrated. 6x9 in.; cloth, $3. New York, 1908: Hill Publishing Company.

The metallurgy of iron and steel has made, during the past two decades, as great an advance as the business based upon it. The enormous increase of product throughout the world is not due merely to the building of additional works of the old type, and the employment of additional laborers after the old fashion, but much more to the introduction of new methods and appliances, and the concentration of industry in the hands of firms and corporations having abundant capital, and both able and willing to pay for scientific guidance, costly experiments, and the continual reconstruction or replacement of plants and machines. And the sudden leap of America to the first rank as a producer of iron and steel—her product being now nearly as great as that of all other nations together—has been the result, not merely of her national resources in ores and fuel, but still more of the freedom and energy with which American ironmasters have adopted, enlarged and perfected modern improvements in metallurgy, machinery and transportation. Whoever would see a striking illustration of this proposition has only to study the report of Sir Lowthian Bell, written 18 years ago, on the conditions of the American iron and steel manufacture. That most competent of all living authorities, weighing with wisdom and acuteness the many difficulties and disadvantages which surrounded that industry in America, arrived at conclusions, which could not then be disproved, concerning the necessary natural limitations of our advance. Yet these conclusions are obsolete already (though Bell's method of reasoning is as sound as ever), simply because the factors with which he reckoned have been wiped out, and other figures have been substituted, by the advance of the arts and the transportation of the means, involved in the problem.

It is of the highest importance to all of us that the record of such progress shall be kept up to date. Our old textbooks need to be re-interpreted, if not replaced; and students and practitioners alike need modern guides to the intricacies of a practically new art. Such a guide, terse, clear, and comprehensive, Professor Stoughton has furnished in this new manual. It is appropriately dedicated to Prof. H. M. Howe, the results of whose acute investigations are among the data which it summarizes; and it presents a survey of the latest theory and the latest practice in the production and manipulation of iron and steel which could not well be improved without enlarging its bulk. Bibliographical lists of authorities at the end of each chapter assist the reader in further investigation. There are, in all, only 190 of these references (not counting those which occasionally occur in the text itself); but they are well chosen, and sufficient for the use of undergraduate students. Moreover, they would, upon consultation, supply even the most advanced investigator with all the further clues he could desire.

For busy people, the index is not as full as it ought to be. I wish our scientific authors would learn and lay to heart the great truth that an alphabetical index cannot well be too full, if the book be one which is intended for frequent consultation. Every one who uses many books in that way, as I am obliged to do, will confirm my statement that I always turn first to certain volumes on a given subject, because I know that the index will tell me in a moment whether they contain what I want, and that there are other volumes, of even greater authority, which I approach with reluctance, as a last resort, because I know that I shall have to rummage in them, and perhaps read page after page of undesired information, before reaching the thing I am seeking, or, worse yet, arriving at the uncertain conclusion that it is not there—unless I have missed it! Only yesterday, I had to answer a query about a certain modern process of steel-making, concerning which only the name of the inventor was given. Feeling quite sure of Professor Stoughton's accurate knowledge of the process, and not quite sure of my own, I consulted his book; found nothing in the index under the name of the process, or under several other titles which I fancied to be relevant. But at last, I came upon an elegant, compact and complete discussion of the whole thing—just what I wanted, and more—under a special italicized title. "———'s Process," which had not been indexed at all! How grateful I was for this abundant and satisfactory information! and how I grudged the 10 minutes which I had wasted in getting at it!

In spite of such small criticisms, I am very grateful to Professor Stoughton, and I think all iron and steel metallurgists will be likewise grateful, for this convenient, trustworthy and intelligent manual of present theory and practice in the most important department of modern metallurgy.

R. W. Raymond.

According to George Loving (*Electrical World*, Jan. 4, 1908) tantalum and tungsten lamps, from the standpoint of current, candle-power, total watts and watts per candle, are less susceptible than carbon filament lamps to changes in electrical pressures.

Phosphate Mining in Tennessee

By H. D. Ruhm*

The month of February was fairly active in phosphate shipments and considering the extremely bad weather, mining progressed rather favorably. The total shipments during February from the Mt. Pleasant station were 488 cars equivalent to about 14,100 tons which is a 25-per cent. increase over January. Fertilizer shipments from the three factories here, aggregated 187 cars or about 4700 tons, against 1000 tons in January. Production for February was considerably less than shipments; stocks on hand were reduced to less than 50,000 tons available for all grades.

The idea has become rather prevalent that the manufacturers have been holding off from receiving rock on contracts, with the view of breaking prices by so doing; but a careful analysis of the situation does not seem to warrant this assumption. The principal users of rock from the Tennessee field are owners of large supplies of rock, and it would seem foolish on their part to depreciate in value their own holdings, merely to enable some other fellow who has not taken care of himself in that direction, to reap the benefit of lower prices. Yet these people are shipping less to their own factories than the independent mines are shipping to others. A more conservative view of the situation, and one that seems now to accord most thoroughly with the facts, is that the manufacturers have simply been up against the prevailing situation in a financial way, and have been in a panic of their own, lest they be caught with a lot of material on hand and large indebtedness out against it. Therefore they have been bending every effort toward getting this material out of their factories, and into the hands of the farmers or dealers, where it would be represented by good paper. For this reason practically no attention has been paid by them to the rock market. Of course this procedure is bound to result in leaving them with empty bins and storage sheds by the end of the fertilizer season, and they will then have to go out of business or purchase their usual supplies of rock.

The Florida pebble people have commenced to slash prices in their old-time style and it is claimed that 68- to 72-per cent. rock is now offered there at $3.50 per ton. However, they did the same thing two years ago, selling down to as low as $1.75 per ton, and yet the Tennessee field went steadily and serenely on up to a much higher level of prices. Of course in much territory that is accessible to the pebble district this will hurt the Tennessee market; but there is a sufficiently large territory inaccessible to the pebble district, to afford Tennessee a large output at reasonable prices. There is no good reason why miners should get less than $6@6.50 for "75—5½—3" rock in Tennessee, nor $5@5.75 for "70—7—3" rock.

Fertilizer manufacturers, who know their business, really know that they are wasting immense amounts of material by improper acidulation, and that they can actually obtain much greater efficiency than they now are doing with Tennessee rock. The high content of iron and alumina is used by them as a convenient lever to decry the product and reduce the price; but in reality it is no more objectionable as far as actual results show, than so much carbonate. Therefore there is bound to be always an active demand for the high-grade rock of Tennessee, both in export and domestic markets.

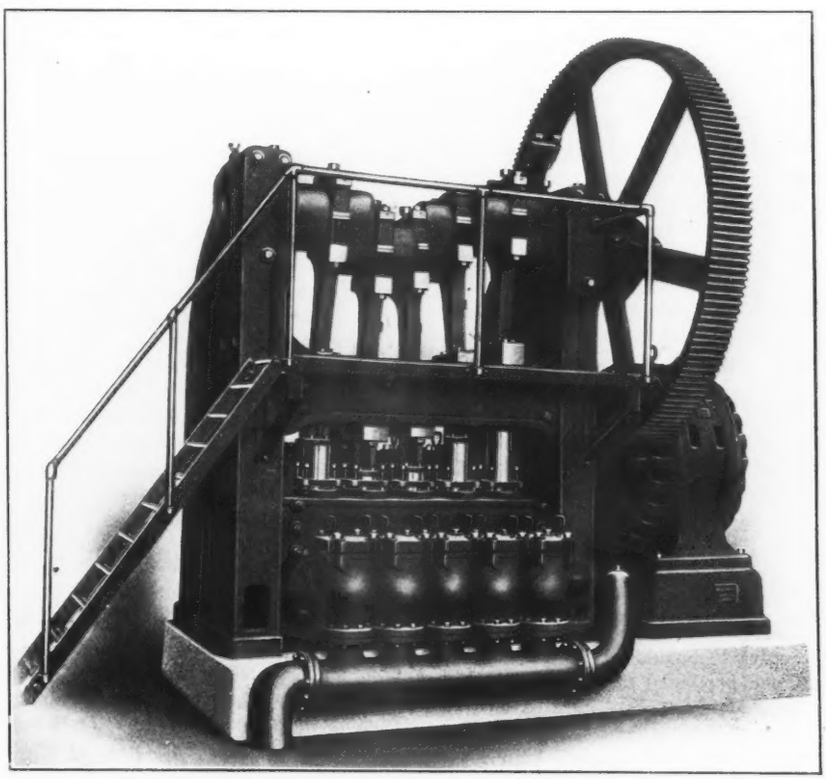
There have been two small sales at prices below the above figures, but in both instances it was by parties who had certain definite royalties to pay, regardless of mining, and who hence had to market their product or lose the opportunity to mine what they had already paid for. There always has been and will be more or less of this class of rock on the market. On the other hand a 25,000-ton contract for 75-per cent. rock for export, was recently closed around $6.50 per ton, according to authoritative report. One sale of a few hundred tons at $7 per ton for 78 per cent. domestic, was also made.

On the whole it does not seem that there will be any trouble in maintaining prices, but it is not reasonable to expect so active a year in mining as we have been having. Just as in all other lines of industry every one will have to be a little more economical and matters generally must be given time to adjust themselves. Interest is still rather warm in investment circles and much attention is being given to purchases of property. Five buying plants, which were inactive last month, have resumed on a full working basis, and three more are expected to resume work in March.

*Mining and civil engineer, Mt Pleasant, Tenn.

Electric Pumps at Butte, Montana

At the Gagnon, Minnie Healey and Rarus mines, Aldrich quintuplex, plunger pumps have been installed. The pump, which is shown in the accompanying halftone, is a 6x12-in. Aldrich, vertical, quintuplex pump having a capacity of 425 gal. per minute against a head of 1100 ft., and is made by the Allentown Rolling Mills, Allentown, Penn. A Westinghouse, "C. C. L.," alternating-current motor, developing 150 h.p. at 450 revolutions per minute, is used to run this pump.



ALDRICH VERTICAL QUINTUPLEX PUMP

Owing to the acidity of the mine water and its strong corrosive action, the plungers, throat and other parts of the pump coming in contact with the water have to be made of an acid-resisting material. The five plungers, operated from one shaft, are placed 72 deg. apart so that they give a uniform velocity to the water in the pipes. These plungers are single acting and outside packed. The throat and valves are made large so that the velocity of the water in the pump is kept comparatively low.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

William Q. Ranft, vice-president of the Iron Mountain Tunnel Company, of Missoula, Mont., is in New York.

Edward K. Judd, of New York, has left to examine coal properties in the northern part of Vancouver Island, B. C.

H. W. Turner has established an office as mining geologist and engineer at room 709 Mills building, San Francisco, Cal.

Floyd Harmon, former manager of the Temiskaming Mining Company, Cobalt, Ont., has gone to Nevada to take charge of a mine there.

Edwin C. Holden, of Hill, Holden & Irvine, consulting mining engineers, of New York, has gone to the Black Hills on professional business.

Professor Robert H. Richards, of the Massachusetts Institute of Technology, is making a short professional trip to Pennsylvania.

Sidney E. Bretherton, general manager of the Great Western Gold Company, Ingot, Cal., is visiting New York and Boston on business in connection with his company.

Director Vehling, manager of the steel works at Rothe Erde, Aix-la-Chapelle, is now in this country. He was until recently connected with the great steel plant at Homécourt, France.

Hon. M. L. Hewett, president of the Montana Mine Owners' Association, which organization has in hand the construction of an independent smelting plant in Montana, is visiting New York.

Charles F. Spaulding, of Needles, Cal., has been appointed superintendent of the Antigua Gold-Copper Company, at Minas de Oro, Honduras, and sailed from New Orleans to Central America March 5.

Nelson Nyberg, formerly manager of the Boca del Cobre Mining Company at Luis del Cordero, Durango, Mexico, is engaged in opening up the old Peñoles mine, of the Peñoles Mining Company.

Francis T. Havard, who during the last year has been in Chile, constructing and putting in operation a copper smeltery for the Copiapo Copper Company, Ltd., at Puquios, Chile, has returned to the United States.

L. S. Scott, secretary-treasurer of the Antigua Gold-Copper Company at Minas de Oro, Honduras, sailed from New Orleans March 5, on his return to the mines, after a stay of two weeks in the United States.

Fred. W. Wood, president of the Maryland Steel Company, Sparrow's Point, Md., has returned from a trip to Cuba, where he visited the iron mines of the Spanish-American Iron Company at Daiquiri and at Mayari.

H. L. Charles, former manager of the Bingham Consolidated Mining and Smelting Company, at Salt Lake, Utah, has accepted the management of a lumbering enterprise in the Canadian Northwest, and will establish headquarters at Lethbridge, Alberta.

E. W. Durfee, formerly of the Alvarado mine, near Congress Junction, Ariz., has been appointed general superintendent of the Daly-Judge mine and mill at Park City, Utah, succeeding Frederick W. Burrall, who has accepted the post of general manager of the Arctic Coal Mining Company, operating at Trondjem, Norway.

E. T. Hazleton, former superintendent of the United States Smelting, Refining and Mining Company's Salt Lake valley plant, has been appointed general manager of the South American enterprises of the United States company in Peru. William Rector Lee, formerly foreman of the furnace department of the United States smelter at Bingham Junction, Utah, accompanies Mr. Hazleton as superintendent.

J. Stephen Jeans, editor of the *Iron and Coal Trades Review*, London, recently resigned as secretary of the British Iron Trade Association, after 30 years of efficient service. Mr. Jeans' many friends in the United States will regret to learn that ill health was the reason for his retirement from the above work. Mr. Jeans is spending the winter on the continent and is reported to be making progress toward recovery.

Obituary

Gustaf Mauritz Westman, a chemist and mineralogist, who had made many inventions and was recently engaged in working out a new process for reducing refractory metals and making wrought iron, died suddenly in New York, March 6. Although he was 73 years old, Mr. Westman had been working hard of late to perfect his inventions, and his health gradually broke down. Mr. Westman was born in Westeros, Sweden, where his father was government superintendent of iron works. He was graduated with first honors from the University of Upsala. He worked as a mining expert in the Ural mountains for a time, and finally introduced the open-hearth steel process into Russia. He came to this country in 1887 and started a foundry at Hackettstown, N. J., but the factory failed, and since that time he had been working on various iron processes.

Tom Cobb King died at East Orange, N. J., Feb. 27. He had been well known in the iron industry for the past 15 years. For a time he was engaged in blast-furnace operation in the South and later in the Pittsburg district. In recent years he worked on the problem of flue-dust utilization and developed a process for nodulizing fine ores and flue dust, which was acquired by the National Metallurgic Company, a plant being built by the company near Newark, N. J., for the manufacture of iron-ore nodules from pyrite cinder. Mr. King also brought out several other inventions in connection with mining machinery and metallurgical processes. He was born at Marion, Ala., in 1865, and graduated at Howard College in Alabama. Mr. King was a member of the Iron and Steel Institute and the American Institute of Mining Enzgineers. His widow and a son survive him.

Societies and Technical Schools

American Institute of Mining Engineers—The next meeting of the institute will be held in October, in Birmingham, Ala.

Machinery Club of New York—This club has issued an attractive description of the rooms it has secured in the Hudson Terminal building, on Church street, New York, in the center of the machinery district, which will soon be ready to open. There are now nearly 1000 members. The officers of the Machinery Club are as follows: F. H. Stillman, president; R. C. McKinney, vice-president; Walter P. Pierce, treasurer; Seton Henry, secretary. The board of governors is as follows: O. C. Gayley, George A. Post, Walter L. Pierce, F. H. Stillman, C. A. Moore, R. C. McKinney, W. P. Pressinger, T. N. Motley, Henry Prentiss, H. L. Shippy, A. B. See, W. H. Marshall, H. B. Kirkland, E. H. Wells, W. L. Saunders, Otis H. Cutler, J. R. Vandyck, Kenyon B. Conger, Wm. B. Albright, Chas. A. Shieren, Jr. This list includes many representative men.

California State Miners' Association—The annual convention of this association was to have taken place in November last, but was postponed subject to the call of the executive committee, owing to conditions connected with the financial stringency at that time. The committee then thought the convention would be called for February or March, but recently decided to let the matter rest for the present. Citizens of San Francisco are being called upon for heavy subscriptions for improving local sanitary conditions so as to ward off possibility of an epidemic of bubonic plague, and also for money for the entertainment of the officers and men of the fleet of warships now on the way to the port. As the Miners' Association is dependent for its income largely upon the manufacturers and agents in San Francisco, who have usually subscribed liberally for the expenses of the convention, it is thought proper at this time not to call upon them for money. There was no convention held in 1907, and it is hardly probable that one will be

called before the fall of 1908. In fact there are no subjects demanding the urgent attention of the miners of the State, just at present, and the convention would have little before it at this time.

Industrial

The J. R. Alsing Engineering Company, of New York, has published a little pamphlet describing the evolution of tube mills.

The American Water Softener Company, Philadelphia, has opened a filtration department under the management of Geo. F. Hodkinson.

The Indiana Steel Company has let the contract for the erection of a two-story brick and steel laboratory to be built at Gary, Ind. It will be 53x63 ft. and will cost $35,000.

The largest iron casting ever turned out in Colorado was produced by the Colorado Gray Iron Foundry Company, Denver. It weighed 30,000 lb. and is part of a smelter equipment in Topeka, Kansas.

The United States Tool Company, of Vincennes, Ind., has been incorporated to manufacture all kinds of mining machinery, mining tools and miners' supplies. John S. Surbaugh, C. R. Anderson and L. K. Kountz, directors.

At the annual meeting of the stockholders of the Galena Iron Works Company, Galena, Ill., these directors were elected: R. Barrett, David Sheean, Henry Oldenburg, W. F. Sargent, C. C. Mathey, C. W. McIlhon and A. Weirich.

The Massachusetts Fan Company, Watertown, Mass., has issued an additional section of its perpetual catalog. This section, which comprises 16 pages, is entitled "Vertical and Horizontal Engines for Fan Driving."

The British Mining and Metal Company, Ltd., of London, has issued the "Metalloys Diary," a pocket book in attractive form, containing a diary for the year 1908, with a number of tables and other information, making it exceedingly serviceable as a small pocket reference book, as well as a diary.

The Electric Cable Company, 17 Battery place, New York, whose plant at Bridgeport, Conn., was partially destroyed by fire, announces that it has made arrangements for filling all orders received for its various products, including voltax protective compound; rubber-covered wires; weatherproof wires and cables; magnet wire, etc.

The Wisconsin Engine Company, of Corliss, Wis., has received the resignation of Frank Engelhardt, who was in charge of the Chicago office of this company, and has decided to close the Chicago office in March, and for the time being to conduct the business from that district under the direct charge of C. T. Myers, general sales manager at Corliss.

Cyrus W. Robinson, of the Teziutlan Copper Company, has closed two contracts for aërial wire-rope tramways, with the A. Leschen & Sons Rope Company, at La Aurora, Pueblo, Mexico, where the Teziutlan Copper Company is building a new plant. The longer of the two tramways will be of the Leschen company's special automatic type, and the shorter one of the friction grip type.

The American steel and iron trade is not the only branch of that industry in which December's results showed a sensational change. The Steel Works Association of Germany has just issued its report for that month. In steel for manufacturing purposes, the average monthly shipments for the first ten months of 1907 had been 136,600 tons; in December they dropped to 81,700 tons, while the shipments of structural goods dropped from a monthly average of 155,500 tons to 58,279 tons. Orders booked by the Düsseldorf Pig-iron Syndicate by Jan. 1, aggregated only 173,000 tons, as against no less than 953,000 tons at the beginning of 1907.

According to the report of the receivers, the liabilities of the Southern Steel Company are $9,000,000 in all, $5,000,000 of this being in first-mortgage bonds and $2,000,000 of the liabilities being unsecured. The holders of the mortgages are expected to receive all that is due them, as the property is estimated to be worth considerably more than the amount for which it is mortgaged. About $2,000,000 of the company's indebtedness is unsecured. To pay off this indebtedness there are assets amounting to over $90,000. The course to be followed by the committee on reorganization which is now engaged in getting possession of the first-mortgage bonds, it is understood, will be to foreclose the mortgage and buy in the property. The property is now in the hands of the trustees appointed by the creditors.

The new plant of the Ash Grove Lime and Portland Cement Company, Kansas City, Mo., now under construction at Chanute, Kan., is being equipped with the latest types of machinery, suitable for a large production. There are to be five 125x8-ft. rotary kilns installed and the fuel to be used will be natural gas, of which the company now has a flow of 130,000,000 ft. per day. The power plant from which the entire mill will be operated will contain four 22x42-in. Reynolds Corliss engines, purchased from the Allis-Chalmers Company, Milwaukee, Wis., through the Hunt Engineering Company, Chicago. These engines will be connected by rope drive to line shafts operating the cement-making machinery. This company, which has been established for a good many years, will turn out from the new plant a high grade of portland cement for which it has a good market in the immediate vicinity.

Trade Catalogs

Receipt is acknowledged of the following trade catalogs and circulars:

Piqua Blower Company, Piqua, Ohio. Piqua Positive Blowers and Piqua Motor-Driven Blowers. Folders, 9x12 in.; 1908.

Edison Portland Cement Company, New Village, N. J. Portland Cement Manufacture. Pp. 64, illustrated, paper, 8x11 in.

Union Elevator and Machine Company, Chicago, Ill. Contractors' and Railway Supplies. Pp. 140, index, illustrated, paper, 7x9¼ in.; 1908.

Jacobson Machine Manufacturing Company, Warren, Penn. Bulletin "F." The Jacobson Gas and Gasolene Engines. Pp. 16, illustrated, paper, 6x9 in.

Green Fuel Economizer Company, Matteawan, N. Y. Catalog 106. The Book of the Economizer. Pp. 158, index, illustrated, paper, 6x9 in.; 1908.

Western Electric Company, Chicago, Ill. Bulletin 5910-1. Power Equipment for Railroad Shops. Pp. 32, illustrated, paper, 8x11 in.; September, 1907.

Schutte & Koerting Company, Philadelphia, Penn. Catalog No. 2, Section M. Koerting Water-Jet Educators. Catalog No. 6, Section O. Koerting Oil Firing by Two Methods. Pp. 12, illustrated, paper, 8x11 in.; 1907.

General Electric Company, Schenectady, N. Y. Bulletin No. 4548. Small Motors and Their Application to Machine Tools. December, 1907. Bulletin No. 4560. General Electric Fan Motors. January, 1908. Pp. 24, illustrated, paper, 8x10½ in.

Construction News

Wallace, Idaho—The Idora Mining Company proposes to put in milling and concentrating machinery. The company's office is at Spokane, Washington.

Fort Mill, South Carolina—The Clawson Mining Company proposes to put a stamp mill and chlorination plant on its property. C. L. Clawson, Richburg, S. C., is president.

Burnt River, Oregon—The Western Exploration and Dredging Company has been prospecting with drills, and has decided to build a large dredge. H. W. Goode, Portland, Oregon, is president.

Wadsworth, Nevada—The Sierra Power Company will put in electric-power plant on the Truckee river, with transmission lines to several mining camps, including Olinghouse and Rawhide. E. R. Dodge and J. G. Harris are the chief incorporators.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Denver, Salt Lake City, San Francisco and Butte

REVIEWS OF IMPORTANT EVENTS

San Francisco

March 4—The storms of the past week on the mountains and foothill regions of the State have piled up the snow to an extent that insures a good water supply for the coming mining season. The reservoirs of the great water companies have been filled and there is an abundance of snow left packed to melt slowly in the spring and summer months, and continue to fill the streams, water courses and ditches long into the dry months of a California summer. In the Sierras and the foothills in the central and northern portion of the State there are extensive reservoirs and ditch systems built in the prosperous days of hydraulic mining, which are now being utilized, not only for mining, but for power purposes. A heavy fall of snow in the Sierras is therefore important as it makes a storage supply to furnish water long after the rain and snow-fall has ceased. With a good fall of snow followed by cold weather, and not warm rains, the miners are always assured of a steady and long-continued water supply in summer. It looks at present as if the coming summer would be one marked for active placer-mining work owing to the abundance of water.

It was mentioned in a recent letter of this series that the Bangor Gold Mining Company, of Butte county, had been organized and that the five directors had subscribed a total of 50c. to the capital stock. Now comes the Laurel Hill Mining Company, of Fresno county, which has amended its articles of incorporation so as to have a capital stock of $20,000, or two million shares of one cent each, and limiting indebtedness or liability at any time to $12,000.

The smelter of the Bully Hill Mining Company, at Winthrop, Shasta county, will not be blown in until the end of this month. The smelter has been closed for the last two years. At Kennett, in the same county, the converters of the Mammoth Copper Company were started up on March 2, making blister copper. Heretofore only low-grade matte has been made at this plant, which was shipped East for refining. Additional electric power has been brought into Kennett, so the company now has 10,000 h.p. available.

A new mining district discovered about six weeks ago is that of Florence, in Inyo county, 20 miles west of Death Valley Junction, on the west slope of the Funeral range. It is reached by wagon from Death Valley Junction. The water supply is derived from Miller's Springs, five miles distant. A townsite has been laid out and named Kilker. The ores are mainly of copper, though some gold is obtained.

By rather a curious accident a short circuit in a high-tension power line was created, causing a fire which destroyed the hoisting works, etc., of the White Oak mine, near Shasta, in Shasta county. In investigating the cause, it was found that an owl with a rabbit in its claws in flying past, struck the upper wire and the rabbit struck the lower one, bringing about a short circuit.

The suit of S. J. Wright, as trustee of the Dutch Mining and Milling Company against the Rawhide Gold Mining Company for a perpetual injunction and $250,000 damages has been transferred from the Superior Court of Tuolumne county to the United States Circuit Court. It is alleged that the Rawhide company, W. A. Nevills, manager, has been taking out and disposing of the ore of the Dutch mine until the latter has been the loser to the extent of 20,000 tons.

Another case of a similar nature is that of the action of O. J. Martin against the Nimshew Gold Mining Company, in Butte county. Martin asserts that the Nimshew Gold Mining Company has run tunnels into his land and taken large quantities of gold. These tunnels are run from tunnels on the mining company's ground. The plaintiff alleges that unless the defendants are restrained from working farther on his land it will be impossible to determine the amount of gold they have taken out. He asks judgment for $10,000 and that the defendants be restrained from working on his ground. The Nimshew Gold Mining Company is composed of twelve or fourteen sea captains who were induced a few years ago to invest in the mine. Their investment has paid well, for the mine proved a rich one.

The city trustees of the town of Oroville have granted certain dredge-mining concessions in the streets to James C. Gray. The trustees wish to improve these streets by getting certain of them continued or extended through town. The City Gardens, now a stagnant pool, will be filled in, laid out in residence lots, and three streets will be extended and put in good condition without expense to the city. At the same time the trustees have decided to listen to no more petitions for dredge operations to work in town for the gold or the extraction of gravel, and are considering a formal way of putting themselves on record in this respect. Henceforth the dredge operators now at work must improve the section of the city which they dredge. A dredger at work in Sacramento, has been taking out sand running as high as $1.50 per cu.yd., but it has not been utilized for its gold content. The dredging is being done for another purpose.

Salt Lake City

March 6—Application has been made by the Utah Mine and Smelter Supply Company for a receiver to take charge of the affairs of the Holderman Filter Tank Company, which is indebted to the applicant to the amount of $14,894.21. It is alleged that the Holderman company has obligations of more than $60,000 outstanding.

The ninth section of the Utah Copper Company's concentrating mill at Garfield is ready for commission. The plant is now equipped to handle 4500 tons of ore per day.

The executive committee of the Utah Mine Owners' Association will hold a meeting next week, at which matters pertaining to the erection of the proposed independent smelter will be discussed. It is claimed that negotiations regarding the erection of the smelter have progressed satisfactorily and that it is not improbable that ground will be broken some time during April.

The board of directors of the Daly West Mining Company, chosen at the annual meeting in Denver, has effected an organization, which is the same as last year. J. E. Bamberger is president of the company. The second quarterly dividend has been passed. It is hardly probable that dividend payments will be resumed before the end of the year.

The water in the Ontario mine, at Park City, is about 90 ft. below the 1200-ft. level, or a little over 200 ft. above the adit level. The water is subsiding at the rate of nearly 5 ft. per day.

The lead smelter of the United States Smelting, Refining and Mining Company has finally been closed and no steps will be taken toward a resumption of operations until after the application made by the company for a modified decree of court which will come up for a hearing on March 30. The executive committee, that represents the interests of those who

applied for the original injunction, has stated that it will resist any action for a modification of the decree. It is believed, however, that the smelting company will obtain a modified decree from the court by showing that the filtering of the fumes through the bag-house, with which the plant is provided, is a complete success. No steps will be taken toward resuming at the copper smelter until after a modified decree permitting the operation of the lead smelter is obtained.

Considerable prospecting for oil will soon be done near the town of Juab, in Juab county. Several drilling outfits, which are to be delivered during the present month, have been ordered.

At the mine of the Utah Copper Company, in Bingham cañon, the mining of ore has been stopped until the concentrating mill at Lark is completed, but development is continued. At the mill construction work has stopped until the financial condition of the company is straightened out. The mill building is finished and ready for the installation of equipment. The mill will have a capacity of 2000 tons per day.

Butte

March 11—The managers of the various amalgamated subsidiary companies are striving for economy in the cost of production of copper with a view to a saving of about 2c. per lb. During the hight of the copper prosperity the cost item was not so closely watched, and permanent improvements and extensive prospecting and development work added greatly to the cost of production. All of such work has been eliminated, wages have generally been reduced in conformity with the contract between the employers and miners' union, and the bosses are getting better results from the miners since the resumption of operations.

Work is again progressing at all of the Amalgamated mines, and the Washoe smelter at Anaconda is gradually being put into commission. The concentrator was started last week and this week the furnaces were fired up. It is anticipated that by next month the Washoe will be turning out copper at its normal capacity of 15,000,000 to 17,000,000 lb. per month. The output of the Amalgamated smelter at Great Falls will also be increased. A portion of the plant had been shut down during the curtailment and only about 3200 tons per day were treated, although its capacity is about 3600 tons. Improvements are under way which, when completed, will increase the capacity about 1000 tons per day, making the total capacity 4600 tons daily. It will be some time, however, before these improvements are completed.

It is announced that the Washoe smelter will resume the purchase of custom ore as soon as it is fully in operation, which will mean a resumption of work at the mines of the East Butte company, Amazon-Butte and others. It is expected that by the latter part of April the Butte district will again be producing about 28,000,000 lb. of copper per month.

Denver

March 6—The production of the Cripple Creek district for February is given as 58,622 tons of gold ore, having a value of $1,251,000; this is a gain in tonnage over the corresponding month of 1907 of 15,122 tons. The report of the general manager of the Elkton mine in that district states that there is $350,000 in the treasury, and that the second dividend of the year will be paid this month. The dividends paid last year amounted to $187,000.

Lessees, who are working through the Good Will adit, which was driven from Cottonwood gulch into Gold hill to connect with the Anchoria-Leland shaft at a depth of 700 ft. below the surface, are shipping good ore from the properties of the Progress and the Fair Chance companies. This adit, 3000 ft. long, intersected at depths varying from 150 to 750 ft., ten veins which outcrop at surface. It was not a financial success for the reason that none of the veins showed pay ore where intersected. Most of these veins were being worked profitably near surface, but the owners declined to prospect these veins from the adit, although they could have trammed the ore to the surface for 50c. per ton. The adit is now leased.

The deep drainage adit at Cripple Creek is now 1660 ft. long.

Some lessees on the Lucky Gus have shipped a carload of ore having a gross value of $5174. This mine was originally owned by Hendersons Goldfields Consolidated, a London-South African company, and it ultimately passed into the hands of the Stratton estate.

The Carbon Lake mine of the San Antonio company, in what is known as the Red Mountain district, between Ouray and Silverton, appears likely to make a good record as a copper producer. Last summer, 42 cars were shipped which showed an average value of $22 per ton for the 987 tons. The mine will now be developed at a depth of 500 ft. below the surface by an adit a half-mile long.

In the vicinity of Craig and Lay, in Routt county, on the line of the Moffat road, a great deal of placer mining is projected; three dredges will be at work there this season. The Colorado Mines and Water Company has men already at work, getting out coal, and overhauling its dredge. The old Law dredge, north of Craig, has been purchased by the Housel-Melner company and is being moved upon their property, where new buildings and engine rooms have been erected during the winter. The Gooldy company is building a ditch and pipe line which will cost, when completed, about $250,000; it has had ten teams at work all winter. The Howard-Merill Mining and Development Company, which is financed by Eastern capital, will also do considerable work this summer. A. G. Wallihan, of Lay, who with his associates owns over 4000 acres of good placer ground, has been busy on the ground all winter, getting ready for this summer's work. Compared with other counties of Colorado, according to the Government report for 1906, Routt county was third highest in the list for the production of placer gold.

As the result of the arrest of 34 "high graders" in the Silverton district, anonymous threats were sent to officers of a mining company, who promptly discharged 60 foreigners of mixed nationality, their places being taken by American miners. It seems probable from the feeling aroused that ultimately the foreign element will be eliminated entirely.

The Iron-Silver mine at Leadville is now shipping 50 tons of ore per day from its Tuscan shaft; this tonnage will be increased very shortly. The shipments of the entire district increased 10 per cent. during February.

The Colorado Yule Marble Company has the contract to supply the white marble for the Mahoning county court house, at Youngstown, Ohio, and for the new court house at Cleveland, Ohio. The quarries are on Whitehouse mountain near the town of Marble, and are reached by the Crystal River Railroad, which connects with the Denver & Rio Grande Railroad at Carbondale.

Toronto

March 6—A rush is expected, early in the season, to the new silver camp in the unsurveyed territory south of Lorraine township. It is about 22 miles southeast of Cobalt and 3.5 miles east of Lake Temiskaming. The first discovery was made late in 1907 since which time about 200 to 300 claims have been staked. There is a winter road through the bush to Temagami station, on the Temiskaming & Northern Ontario Railway, 10 miles distant.

Notwithstanding the depth of snow in the Montreal river district, prospecting has been actively carried on throughout the winter and many good finds of native silver have been reported. A number of the claims in this area have passed inspection and a map showing all passed claims is being prepared by G. W. Dixon, of Cobalt.

E. L. Englehart, chairman of the Temiskaming & Northern Ontario Railway commission, states that low-grade Cobalt ores are likely, in the future, to be extensively shipped to British Columbia smelters, for treatment with those of that district.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

Alabama

JEFFERSON COUNTY

Birmingham Coal and Iron Company—The two large mines which this company is opening at Mulga, on the Atlanta, Birmingham & Atlantic road, are nearing completion, and will soon be shipping coal.

Arizona

YAVAPAI COUNTY

Cardinal Mining Company—This company is taking out milling ore which it is running through the Poland American Mill, at Poland. A large amount of high-grade milling ore has been developed and this run is being made for the purpose of determining the kind of a mill most suitable for the company's ores.

Hackberry Mining, Milling and Development Company—This company has resumed operations at its mines near Cherry; work had been suspended for a short time owing to the bad condition of the roads.

McKinley Mining and Development Company—This company reports a strike of good ore in the bottom of its shaft, the depth of which is 130 ft. The ore opened is a copper sulphide and is said to assay from 10 to 20 per cent. copper besides some gold and silver. The mines are near Iron Springs, about 12 miles northwest from Prescott. A hoist and air compressor will be installed.

New England & Arizona Gold and Copper Company—Jack Farrel, general manager for this company, reports that he is now opening a large body of low-grade gold and copper ore. Sinking has been suspended and all work is now being done in the drifts off the 200-ft. station.

Spec Gold Mining Company—This company has made a test run with its gold dredge on Lynx creek, eight miles west of Prescott, and after some changes will attempt to make a steady run. The bars, which are known to be rich, contain large boulders difficult to handle.

Snoozer Extension Mine—At this mine a body of milling ore 8 ft. wide has been opened. The mine is the property of W. J. Kearney and associates and adjoins the Senator mines, owned by Phelps Dodge & Co. Prescott is the nearest point on the railway, being about 10 miles north of this mine.

H. J. Beemer Company—This company has resumed work at its Storm Cloud mines 10 miles south of Prescott. The mines have been shut down for some months on account of the financial stringency. It is also said by the management that shipments of ore will be resumed in a short time.

United Verde—The large drain tunnel now being driven by this company, at Jerome, is in over 7000 ft. It is reported, but not authoritatively, that the large smelters of this company will be removed to the Verde river as soon as the tunnel is completed.

California

CALAVERAS COUNTY

Last Chance—A new engine and boiler with some other appliances have been placed in this mine near San Andreas and a small force of men has been set at work.

EL DORADO COUNTY

Gignac—At this mine, Texas Hill, the drift extended into the gravel beds has reached gravel which prospects well. A five-stamp mill has been fitted up to crush it.

Quartz—Michael Martin & Sons have uncovered near Grizzly Flat, after a long search, a high-grade quartz ledge half a mile west of the Mount Pleasant mine.

Smelting Ore—H. R. Leland and partners are shipping ore to the smelter carrying gold, silver and copper, from a new mine at Missouri Flat, four miles west of Placerville.

INYO COUNTY

Silver Cliff—This mine on Treasure mountain, 12 miles from Bishop, is now being operated by the Inyo Mines Syndicate, which has recovered the vein of silver-lead ore.

LASSEN COUNTY

Lassen County Mining and Milling Company—This Los Angeles corporation, of which T. J. Hoyt is president, has started up its 10-stamp mill, and a cyanide plant is contemplated.

NEVADA COUNTY

Conlin—H. G. Brunnier, manager, will resume operations at this mine with a large force of men.

Republic—Negotiations are under way for a sale of this mine near Graniteville. The property has been idle for some time though a large mill has been erected upon it. The mine is under bond to L. F. Bedford, of Rhyolite, Nev., Geo. Wyman, of Rochester, N. Y., and E. W. Estes, of Jersey City, N. J.

Celina—This group of 10 claims in Eureka district, will be extensively developed as soon as the roads are open, by A. H. Tickell and associates.

Belle Union—Stringers of rich quartz have been cut in the adit of this mine and the main ledge is expected to be met with shortly.

Magnet Mining Company—This new company, F. L. McPherson, superintendent, has been organized to work the McPherson group of claims in Washington township.

PLUMAS COUNTY

Arcadia—The recent strike in this mine near Greenville, is in a 2-ft. ledge, 10 in. of which is rich.

RIVERSIDE COUNTY

American Flag—At this mine, C. L. Austin, superintendent, the new mill will shortly be started. There is plenty of ore in sight.

Wiley-Stanchfield—At this property a hoist is to be installed. The ore will be treated at the American Flag mill.

SAN BERNARDINO COUNTY

Big Chief—In the lease in this mine at Hart a small vein running into the thousands per ton has been discovered.

Hart—The water-pipe line, four miles long, from the springs to this new mining camp, has been completed. There are now from 800 to 1000 people in the camp, which is less than two months old. The McGuire & Mahana lease on Or Belle No. 1 is getting out very high-grade ore. The Hitt & Hart tunnel in the same mine is at present the sensation of the camp, very rich rock from a wide ledge having been obtained.

SHASTA COUNTY

Vulcan Copper Company—The Eureka tunnel of this company on Squaw creek is developing good sulphide ore. The tunnel is being run to catch the copper lead discovered in diamond-drilling operations last December.

Sybil—In this property at French gulch, G. A. von Krusze, manager, a ledge of good ore has been found.

Shasta May Blossom Copper Company—President M. Lindley informs us that this company, operating near the Bully

Hill mine, recently drove a cross-drift through its west vein, showing a total width of 40 ft. of vein, with assays showing 6 per cent. copper and some gold and silver.

Victor Mining Company—This company is about to operate the Bonanza mine, about which there was so much litigation in the Harrison Gulch townsite case.

SIERRA COUNTY

Happy Jack—This mine near Alleghany, owned by Chambers & Carroll, has been sold to Dakota men, who will at once proceed to develop it.

SISKIYOU COUNTY

Ricks—The tunnel at this mine near Callahan has reached the shaft and ledge and will increase the output of ore for the new mill.

Champion Group Mining Company—This Portland, Ore., company, having a bond on the Herzog ranch at Yreka, has again commenced development work.

Taylor Lake Mine Company—This company near Etna has struck the ledge in its lower level, and high-grade ore is being taken out.

Minnette B.—This mine has been leased until sold to E. Fehley, who has commenced work upon it.

Hydraulicking—Reames and Hannon have plenty of water at their hydraulic mine at Callahan, and have good prospects for the season's run.

Adeline Ricks—The new mill of this mine is crushing 50 tons of ore daily. Frank Zeigler has recently been appointed superintendent.

TULARE COUNTY

White River District—There has been a revival of interest in this district on the border of Tulare and Kern county and a large stamp mill has recently been built.

TRINITY COUNTY

Quimby—In this mine at New River, the lower tunnel has encountered good ore. In some places the ledge is about 40 ft. wide. When the weather permits a cyanide plant will be installed.

TUOLUMNE COUNTY

River Bed Mining—A company has been organized to work the bed of the Tuolumne river near the Ellen Winter mine.

Kanaka—The new mill at this mine, formerly a producer, has been started up.

U. S. Grant—This old mine in American Camp district is being reopened and the mill repaired.

Idaho

SHOSHONE COUNTY

Nipsic Mining Company—This company has been organized in Spokane, Wash., to operate the Father Lode and a number of other claims lying just west of the Hercules. This is a well-known property and has been a shipper in the past. Development is all on the old Father Lode claim, where four adits have been driven, crosscuts, drifts and upraises made, totaling 2300 ft. of underground work. The company intends to extend the lower adit to intercept an ore shoot shown in the outcroppings. Work has been in progress here for some time, but the crew is to be increased soon with a view to putting the property on a shipping basis.

Evolution Holdings Company — Announcement is made by Supt. F. R. Crocker that the mine will resume operations by March 1. The mine has been idle since last December. The property is developed by a shaft 300 ft. deep, and by several crosscuts at various points. Machinery, including hoist, cage, pumps, etc., has been ordered.

Idora Mining Company—Stockholders of this company met in Spokane, Feb. 27, and elected a new board of directors, and also subscribed 41,750 shares of stock to secure funds for discharging the remainder of the debts of the company. Present plans contemplate the building of an electric power line to the mine and the installation of additional machinery.

Charles Dickens Mine—A new ore-shoot has been struck just off the No. 2 tunnel. The mill, which was burned in January, is being rebuilt and will be running in a short time. New machinery has been added and the plant enlarged.

IDAHO COUNTY

Gold Bullion Mining and Milling Company—The six claims near Buffalo Hump mountain, owned by this company, will be re-opened. A long crosscut tunnel will be driven from the mill directly into the mountain; this will dispense with the use of the aërial tram employed in the past. An electrical cyaniding plant is to be installed in the spring. The mine is well equipped with machinery and has accommodations for 50 men.

Indiana

The State convention of the Indiana coal mines met in Terre Haute, March 6 and 7 and passed a resolution calling for the repeal of the Collins law providing for an increase in the number of mine inspectors, because it has unsatisfactory clauses in regard to the use of powder, which were intended to prevent accidents but also operated to decrease the miners' earning capacity. The size of the drill was restricted that too much powder might not be used, and with lessened explosive force a smaller amount of coal was loosened. Another clause prohibits opening kegs of powder with a pick, which was a time-saving method. A resolution calling for the reinstatement of 29 miners expelled by the executive board because they appealed over the heads of the officials of the State and national organizations to the courts in resisting payment of a fine of $2, on each man, was voted down. The convention passed resolutions indorsing the child-labor bill introduced in congress by Senator Beveridge and commending Senator Hemenway for his persistent efforts to have a bureau of mines established under the department of the interior.

CLAY COUNTY

Collins Coal Company—Suit has been brought by the Union Trust Company, of Chicago in the Circuit court asking for the appointment of a receiver for this company, which owns several large mines near Brazil. The suit is on first-mortgage bonds, calling for $60,000, and it grows out of the failure of O. S. Richardson & Company.

The company went down with assets of $600,000; liabilities $125,000. Mr. Richardson was the largest stockholder. It was hoped that the coal company would not be involved in the Chicago failure, but the Trust Company precipitated matters.

Michigan

COPPER

Lake—The three-compartment shaft on this property is down 100 ft. and the same rich formation continues as was disclosed at the opening. This shaft is going down at an angle of 40 deg., while the pitch of the lode is calculated to be approximately 45 deg. At a depth of 135 ft. the first level will be established and a crosscut will be run which will determine the width of the lode. The surface equipment is sufficient to carry the shaft down to a depth of 500 ft., which will show the value of the lode at depth. The company has about $64,000 and 20,000 shares of stock. The recent sale of 10,000 shares to the stockholders at $6 per share has furnished sufficient funds to carry on operations on a broader scale for over a year, and it is also figured that the rock coming from the openings will pay expenses.

Arcadian—The main office of the company has been established at Houghton, having been moved from Boston recently. Robert H. Shields and William F. Miller succeed A. C. Burrage and C. D. Burrage as president and secretary-treasurer of the company.

Superior—The crosscut from the eighth level is in the copper-bearing formation for a distance of over 25 ft. and the openings in the upper levels continue in the same rich ground. A mill test will prob-

ably be run early this summer and the stamp results determined.

Franklin—On March 9 a fire occurred at the 28th level of No. 5 shaft. All the men were able to escape. The mine has suspended operations throughout all the workings.

Montana

BUTTE DISTRICT

Davis-Daly—A good copper-bearing vein has been cut on the 1000-ft. level, about 160 ft. south of the Colorado shaft. It is believed to be the Baltic fault vein, and runs almost parallel with the crosscut. It is from 15 to 20 ft. wide and carries copper, silver and gold. The company has begun a crosscut at the 800 for the purpose of opening the vein at that depth.

East Butte—The company has sued the South Butte Mining Company, a Lewisohn concern, for $100,000 damages for blowing up an important crosscut into which the South Butte miners recently broke while in search of ore. Another item of the suit is for an accounting on the value of ore alleged to have been mined from East Butte ground and for an injunction to prevent farther trespass.

Butte Central—The affairs of the company are becoming more and more entangled. It has an indebtedness of about $150,000, and many of its creditors have attached the property of the company. A plan was conceived to reorganize the company and place it on a firmer footing with a reasonable capitalization, but some of the stockholders were not consulted and they went into court and blocked proceedings by asking for the appointment of a receiver. The company is capitalized for $7,500,000, and it is proposed to place the capital of the new company at not to exceed $2,500,000, while the Butte stockholders, who are familiar with the mine owned by the company, are advocating a capital of $1,000,000.

North Butte—This company is again producing about 1000 tons of ore per day.

Butte Coalition—Some development work is still carried on and mining is gradually coming back to a normal state. Within a month, it is anticipated, the company will be shipping 1500 tons of ore per day to the Washoe smelter.

LEWIS AND CLARKE COUNTY

Robert Emmett—This group of claims, lying near Amazon, on the line of the Great Northern railway between Helena and Butte, has been sold to Eastern capitalists for $40,000. It is proposed to equip the property with heavy machinery to be electrically operated.

Nevada

ESMERALDA COUNTY—ESMERALDA COUNTY

The Federal troops have left Goldfield and now the Nevada State Police is in charge. It is reported that over 1000 miners are now working in the camp and that less than 100 of these belong to the Western Federation. According to the secretary of the Mine Owners' Association the Goldfield Consolidated was employing, on Feb. 29, 445 men; Combination Fraction, 30; Little Florence, 90; Daisy, 70; Diamondfield Black Butte, 24; Atlanta leases, 145; Nevada Goldfield, 40; Western Ore Purchasing Company, 20; Goldfield Belmont, 18; Kendall, 16; other leases, 125; total 1023 men.

Daisy—Three shifts are working at this mine near Diamondfield; during the last ten days, 200 tons of ore have been shipped to the Western Ore Purchasing Company's sampler. At present ore is being stoped on the 210-ft. level in the raise being driven to the 150-ft. level. On the 400-ft. level crosscuts are being driven from the shaft in both directions.

Little Florence—Every face on the different levels is being worked. The shaft is now 537 ft. deep; 94 men are working at this lease.

Florence Annex—On the third level ore is being mined; some prospecting is being done; 47 men are working at the property. Fifty tons of ore were shipped last week.

Florence—The mill building is nearly finished; as yet the machinery has not all arrived as some of the cars are sidetracked somewhere. The treatment tanks are being put in place. At the mine the 70-ft. headframe is almost completed.

Goldfield Consolidated—At the mill site 125 men are working. The foundations are almost completed; material for the mill has arrived. On the 600-ft. level of the Mohawk a crosscut is being driven to cut the orebody developed by the winze from the 450-ft. level.

Mohawk-Red Top—The sinking of the three-compartment shaft has been resumed; this is 400 ft. deep. A 75-h.p. compressor is being installed. The shaft is being sunk on contract, three shifts being worked.

NYE COUNTY—BULLFROG

Gold Bar—The mill is working satisfactorily but the pipe line has given considerable trouble.

Mayflower—The north drift on the 400-ft. level is being driven ahead with machines. This drift is now 140 ft. long; the face is in milling ore.

Tramps Consolidated—On the 600-ft. level the north drift is 45 ft. long and the south drift 40 ft. A winze is being sunk on the vein; at present the winze is in sulphide ore. On the 500-ft. level, the drift is 204 ft. long. Some of the ore from this vein is being sacked.

Montgomery Shoshone—It is thought that the mill will be running again within a week. The usual development work is being done in the mine and the usual tonnage is being shipped. At the meeting held Feb. 13 in New York, B. W. Turner, the superintendent of the mine, stated that the lowest working was the 600-ft. level where a crosscut is being driven to the vein; that the mill is treating 3000 tons of ore per month, which averages $20 per ton and from which an extraction of 87 per cent. is made; and that about 45 tons of ore, assaying at least $60 per ton, is shipped each day. At present 45,000 gal. of water are being raised from the mine each day.

Homestake—Three carloads of machinery have arrived for the mill. The framing of the timbers for the battery frames has begun and the mortars are being placed on the mortar blocks. It is thought that the mill will be completed by May 1. Development is being carried on in the mine; a body of milling ore has been found on the 500-ft. level. This is said to be 20 ft. wide.

NYE COUNTY—TONOPAH

The ore shipments from the Tonopah mines for the week ending Feb. 27, as reported by the Western Ore Purchasing Company, consisted of 223 tons from the MacNamara, 102 tons from the Midway, and 47 tons from the Tonopah Extension. The Tonopah company sent 4740 tons, the Belmont company 820, the Montana-Tonopah 1100 tons to the mills, making the total shipments for the week 7032 tons.

Tonopah—Ore is being mined and development work is being done on all levels above the 600-ft. in both the Mizpah and Silver Top claims. On the 900-ft. level the drift has followed the quartz vein for a distance of 75 ft.; a crosscut is now being driven from the end of this drift to determine the width of the vein. The usual tonnage is being shipped to the mill.

Belmont—During the last week 293 ft. of development work was done; 16 air drills are being used. On the 600-ft. level the crosscut, being driven to develop the South, Nevada and Occidental veins, was advanced 26 ft. during the week. On the 800-ft. level these veins are being developed. On the 900-ft. level the crosscut, being driven to develop these veins, will have to be driven about 200 ft. farther before it cuts the first vein, the South vein. On the 1000-ft. level the drift, which is being driven east on the Mizpah vein, was advanced 13 ft. The crosscut, being driven to develop the Occidental vein is 319 ft. long. Most of the ore now being mined comes from stopes on the 1000-ft. level, but considerable of the ore is being mined on the 800-ft level from the west drift on the South vein.

Tonopah Midway—A station is being cut at the bottom of the winze from the 835-ft. level; this winze is 200 ft. deep.

Development work is being done on the 835-ft. and the 435-ft. levels. Ore is being stoped, from the Brougher vein, on the intermediate level between the 300-ft. and 400-ft. levels.

North Star—On the 1050-ft. level, ore is being stoped; the vein is said to be 3 to 4 ft. wide. The drift on the 1250-ft. level has followed the vein for a distance of 60 ft. Last week 150 tons of ore were sent to the Montana-Tonopah mill.

STOREY COUNTY

Ophir—On the 2100-ft. level 154 cars of ore were mined and on the 2200-ft. level, 141 cars. During the week, two carloads of ore and one carload of concentrate were shipped to the Selby smelter; 171 tons of ore were sent to the Kinkead mill.

Ward Shaft—The motor to drive the suction fan is being installed. The pump station on the 2475-ft. level is being enlarged.

Andes—Three cars of low-grade ore were mined from the face of the north drift, driven from the bottom of the winze.

Yellow Jacket—During the week, 150 tons of ore was mined from the different levels and sent to the mill. The mill is running successfully, but, owing to a shortage of water, it is not running at full capacity. Arrangements are being made for more water.

Silver Hill—Prospecting on the different levels is continued; 75 tons of ore were sent to the mill during the week.

Crown Point—From the raise near the south line on the 1400-ft. level, 25 tons of ore were mined.

New Mexico

SOROCCO COUNTY

Last Chance—This mine at Mogollon has opened up a large orebody on the eleventh level, which is a continuation of the No. 3 shoot opened on the main adit level. The ore is 12 ft. between walls and the body will add about 80,000 tons of ore to the mine reserve. The 20-stamp mill is handling 65 tons per day, and for the last two years produced about 50 per cent. of the gold and silver sent out from the Territory.

Enterprise—The company has about 250 ft. to run to connect the mine and mill by tunnel. This will lower the mining cost and do away with the expensive burro freighting down the mountain side.

North Carolina

GRANVILLE COUNTY

Virgilina—At this gold mine, three miles south of the town of Virgilina, 20 stamps are running steadily. The mine is now in its third year of successful operation.

MONTGOMERY COUNTY

Iola—This mine produced $9000 gold in January, with 20 stamps running. This brings the total production to date up to over $250,000. There is a large quantity of ore blocked out and 20 additional stamps are being erected. When these are running a production of $1000 per day is expected.

ROWAN COUNTY

Gold Hill Copper Company—This company's stamp mill and concentrators are running on good ore from the W. G. N. shaft at the 800-ft. level.

Southern Mining Company—This company, composed of Cleveland, Ohio, capitalists has purchased important mining property in the heart of Gold Hill, on a newly discovered deposit. It is operating a 10-stamp mill and concentrators, treating about 10 tons per day. From first few days' run the mill produced 30 oz. gold. Most of this ore is coming from near the 100-ft. level. The mine is well equipped with hoister and pumps. J. M. Procter is manager.

RUTHERFORD COUNTY

Golden Valley Mining Company—This company, at Golden, is installing a plant consisting of boiler, engine, pump and Erdman machines, for working the placer ground at the mines. B. Frank Smith, of Ebensburg, Penn., is manager.

Parker Gold Mines—A company of Altoona, Penn., gentlemen have organized for the purpose of operating this property with Frank E. Lloyd, of New London, N. C., as manager. They have put in an Erdman washing plant and are producing some gold from the placer ground.

South Dakota

LAWRENCE COUNTY

Kicking Horse—The pipe line from the mine to the Golden Placer mill at Blacktail is being laid as fast as possible. The ore will be crushed in the former plant and the pulp run through the pipe for treatment at Blacktail.

Branch Mint—Changes are being made in the plates in the 800-ton stamp mill to insure a better extraction. This will necessitate a temporary shut down.

American Eagle—The Burt filter-press system has been adopted and will be installed in the new 200-ton mill in the Ragged Top district.

Reliance—Another important strike has been made in lower tunnel No. 1, the main entrance, where one of the largest orebodies so far found has been encountered.

Imperial—Electric power has been turned on at the Dakota shaft for use in hoisting and drilling. The other shafts will be similarly equipped.

Hymalulu—Preparatory to development of the property on Slate creek, a set of air drills has been installed. The 71-ft. shaft will be sunk deeper and drifting continued.

Tennessee

HICKMAN COUNTY

Richland Phosphate Company—This company has been organized to develop phosphate lands. Incorporators of the company are George A. Washington, E. A. Lindsay, E. W. Foster, J. H. Baird, Henry Sperry, John Branhan, Joseph A. Gray, John H. DeWitt, William Reid and A. G. Maxwell. The new company, it is stated, has purchased the plant and properties of the Paragon Mining Company, with several additional tracts of phosphate land and will make a number of improvements.

West Virginia

FAYETTE COUNTY

Monks-New River Land and Coal Company—This company has been organized with an authorized capital stock of $500,000 to develop coal mines in the Mountain Cove district of Fayette county. Its incorporators are T. C. Beury, G. T. Thayer, J. E. Beury, W. E. Chilton and T. S. Clark, all of Charleston, West Virginia.

Missouri

ZINC-LEAD DISTRICT

The Joplin Stock Exchange is scheduled to open for business about March 20. A great many of the mining stocks of the district are already listed.

Old Dominion—A mill is being erected on the west 20 acres of the Iroquois lease which was recently sub-leased.

Columbia Zinc Company—This Joplin company recently made a second mill-run test of its ore at the mill of the Cambria mine. More than 200 tons of ore was milled and sampled at several points throughout the run. Geo. S. Rice, of Chicago is manager. The mine is owned by men interested in the Sullivan Drill Company.

Hero—This mine, west of Joplin, has shut down for the first time since low prices have prevailed. It is understood that a sale of the property has been made.

Crane Land—A company has been organized to develop the Crane land just west of the rich strike recently made in Carthage. The company has contracted for 1200 ft. of drilling, but will not mine the land. It will sub-lease and act as a royalty company.

Dodsen—This mine in Douglas county has been purchased by Bethlehem, Penn., capitalists for $100,000. This is a lead and zinc property which has never been developed.

Canada

ONTARIO—COBALT DISTRICT

Ore shipments—Shipments of ore for the week ending Feb. 29 were as follows: Buffalo, 63,600 lb.; Cobalt Lake, 64,900; City of Cobalt, 57,060; La Rose, 42,300; Nipissing, 127,530; O'Brien, 64,000; total, 419,380 pounds.

Little Nipissing—The vein recently found on the property leased by this company, from the Peterson Lake company, continues to widen on being further opened. Superintendent Madden is in New York, and will arrange for compressor plants to be installed on both the Little Nipissing and the Peterson Lake properties. Early in the spring the force will be increased and development carried on extensively.

Silver Queen—About 2500 ft. of underground development has been done and the silver content of the ore is officially stated to be as high at the 125-ft. level as it was at the 75-ft. level. A diamond drill, boring from the 125-ft. station, has proved silver to a depth of 400 ft. from the surface. This has decided the management to sink the main shaft to at least this depth. A 12-drill compressor will be installed at once, and the remaining 50 acres of the property will be prospected. A recent shipment of 26 tons is expected to yield about $38,000, and it is stated that there is much more of this high-grade ore in sight.

LORRAINE CAMP DISTRICT

Haileybury Silver Mining Company—This company, whose location is situated in the new field south of Lorraine township, is sacking ore from an open cut on a large vein of cobalt and niccolite carrying silver. Native bismuth has also been found on the property.

MONTREAL RIVER DISTRICT

Cragg Location—Development work is being carried on at this mine, in Smythe township, with a force of 20 men and considerable drifting has been done at the 50-ft. level, where the vein is between 6 and 16 in. in width carrying smaltite with a good percentage of silver.

Downey's Claim.—The vein on this location at Silver Lake has been found to carry considerable silver at a depth of 45 ft.

Mexico

CHIHUAHUA

Dolores—Sixty bars of gold and silver bullion valued at $117,000 were on March 1 received at the Banco Minero, Chihuahua, from this mine west of Madera.

Cranadena—The company operating in the Santa Barbara district has contracted for a steel cableway to convey the ore from the Merced mine to the mill a distance of 300 meters. The company is also installing pumps in the Merced mine which will make it possible to operate the 200-ton mill on a 24-hour basis.

Refugio—This mine and mill at Parral has been sold to A. J. McQuatters and Thos. S. Shepperd, who recently purchased the Beckman interest in the Palmilla lease. The mine is not old but has produced considerable ore.

Magistral—According to reports received in Chihuahua the 200-ton smelting plant at this property was burned to the ground. The mine is 15 miles from the Chihuahua & Pacific Railroad and recently resumed operations after a long suspension. The property is owned by Governor Enrique C. Creel and associates.

DURANGO

Penoles—This old property 34 miles from Mapimi is being opened up by the Penoles Mining Company. A wagon road is being built to connect the mine with the smelting works at Mapimi, where a large tonnage of the ore will be used in the treatment of other ores. Considerable ore is on hand ready for shipment.

GUANAJUATO

El Monte San Nicolas—A strike of rich ore was made in this mine near Guanajuato. The vein is said to be 4 ft. wide and carries silver and gold.

MEXICO

Dos Estrellas—The report of operations at this property during January shows that the mills worked uninterruptedly treating 24,750 tons of ore. Shipments amounted to 341 tons. The value of the product of the mill and the ore shipped was $451,016, the expense of operation, development, etc., being $300,050.

MORELOS

Santa Rosa—At this quicksilver property about 25 miles from Cuernavaca the erection of a furnace is contemplated. The owners are cleaning out the workings and considerable ore is stored.

OAXACA

Oaxaca Coal and Iron Company—Engineers have arrived from London and have begun exploration in the country south of Oaxaca. The company has concessions covering large tracts of territory.

SONORA

Ryall and Mix Concessions—Stockholders of the Douglas Copper Company have secured control of these concessions which cover about 1,500,000 acres of land. The concessions have been taken over by the Mexican Exploration and Mining Company, which has a capitalization of $5,000,000, and of which Epes Randolph, the Mexican representative of the Harriman railroads, is a director.

Africa

TRANSVAAL

The production of metallic ores other than gold in the month of December is reported as follows: Copper ore, 28 tons; lead ore, 63 tons; tin ore, 156 tons. The output of miscellaneous minerals included 33 tons magnesite, 124 tons flint and 2119 tons lime. The production of coal was 242,838 short tons.

The gold output in February is reported at 541,930 oz. fine, a decrease of 18,399 oz. from January. This was due to the shorter month, the daily average having increased from 18.075 oz. in January to 18,687 oz. in February. For the two months ended Feb. 29 the total was 1,031,180 oz. in 1907, and 1,102,259 oz., or $22,783,694, in 1908; an increase of 71,079 oz., or 6.9 per cent. The average daily production for the two months was 17,478 oz. in 1907, and 18,371 oz this year.

Asia

FEDERATED MALAY STATES

The total production of tin from the Federated Malay States in 1907 is reported at 813,636 pikuls, or 48,618 long tons; a decrease of 3150 pikuls from the preceding year.

Dutch East India

The production of tin from the Banka and Billiton mines for the year 1907 is reported as follows: Government mines, 179,300 pikuls; private mines, 37,979; total, 217,279 pikuls, or 12,927 long tons. As compared with 1906, the total shows an increase of 23,886 pikuls.

SUMATRA

Redjang-Lebong Mining Company—This company's production for the year 1907 is reported at 59,928 oz. gold and 322,560 oz. silver; an increase of 14,449 oz. gold and 74,320 oz. silver, as compared with 1906. The ore reserves blocked out at the close of 1907 were 265,000 tons.

Central America

HONDURAS

Antigua Gold-Copper Company—This company has just bought and shipped a complete electric-light plant for its mines at Minas de Oro. The office of the company is at New Orleans, La. W. W. Duson is president.

South America

BRITISH GUIANA

Gold exports in January were 3607 oz. bullion, a decrease of 1492 oz. from January, 1907. The bullion reported this year was equal to $63,079, or 3052 oz. fine gold.

DUTCH GUIANA

The gold production of the colony in 1907 is reported at 1085 kg., or $721,037. This is a decrease of 70 kg., as compared with the previous year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, March 11—The bituminous coal trade in the East continues quiet, with only a moderate demand reported at most points. The anthracite trade is also quiet, with no changes reported from the previous week. The January anthracite statements showed an increase over last year; but the February shipments showed a small decrease, and there is little doubt that a further decrease will be recorded in March.

In the West the wage scales for next year are still the chief topic of discussion. The various State associations have held meetings, but no general agreement has been reached on the part of the operators. The National Mine Workers' convention will re-assemble in Indianapolis, March 12, to take up the matter of bringing about a wage conference with the operators and, in case of failure, to decide upon what course to pursue. The general opinion is that a conference will be held, but that it will not be able to finish its work before April 1.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to Feb. 29, in short tons:

	1907.	1908.	Changes.
Anthracite	857,532	857,717	I. 185
Bituminous	6,233,010	5,246,482	D. 986,528
Coke	2,326,334	1,161,703	D. 1,164,631
Total	9,416,876	7,265,902	D. 2,150,974

Average daily shipments, 154,376 tons in 1907, and 121,098 this year.

Anthracite coal shipments in February were 4,503,756 long tons, a decrease of 59,964 tons from February, 1907. For the two months ended Feb. 29, the shipments, by companies, were, in long tons:

	1907. Tons.	1907. Per Ct.	1908. Tons.	1908. Per Ct.
Reading	1,998,118	20.3	1,933,434	19.1
Lehigh Valley	1,665,770	17.0	1,703,580	16.8
N. J. Central	1,237,919	12.6	1,324,302	13.1
Lackawanna	1,623,031	16.5	1,573,001	15.5
Del. & Hudson	969,053	9.8	1,071,627	10.6
Pennsylvania	901,649	9.3	961,004	9.5
Erie	990,218	10.1	1,107,954	11.0
N. Y., Ont. & W.	427,908	4.4	447,193	4.4
Total	9,813,666	100.0	10,122,095	100.0

The total increase this year was 308,429 tons, or 3.1 per cent.

New York

Anthracite

March 11—The prepared sizes are inactive and in small demand. Consumers are purchasing in small quantities for immediate demands, on account of the usual reduction of 50c. per ton which is made on these sizes on April 1. Among the small steam sizes pea coal is in good demand and is rather short as is also buckwheat No. 1; the other sizes are not particularly active. Prices are as follows: Broken, $4.75; egg, stove and chestnut, $5; pea, $3.25@3.50; buckwheat No. 1, $2.75@3; buckwheat No. 2 or rice, $2.15 @2.25; barley, $1.75; all f.o.b. New York harbor.

Bituminous

Contracts continue to come in slowly, and are nearly all confined to the better grades of soft coal; a few contracts are being made for Pennsylvania coal, but the majority so far have been for West Virginia grades. These contracts are all made f.o.b. mines, and are subject to the through-freight rate when announced by the railroads; it is not believed that rates will be reduced. The demand from nearly all consuming districts is light. Boston and equivalent points show a slightly increased demand, but in the far East and along the Sound trade is very dull.

New York harbor shows no improvement, and good grades of steam coal bring $2.60@2.65 per ton, while some coal has been sold as low as $2.50 per ton. Transportation from mines to tide is good, and cars are in abundant supply. The coastwise vessel trade is dormant; vessels are tied up and owners are indifferent about entering the trade at the prices offered. Shippers are unwilling to pay more than 60@65c. per ton around the Cape, and the little business that has been done was at these prices.

Birmingham

March 9—There is an improvement in the coal trade in Alabama. John Guess, purchasing agent of the National Railway of Mexico, was in Birmingham the past week placing a contract for 120,000 tons of coal to be shipped at the rate of 10,000 tons per month for use on Mexican railroads. The shipments go via Pensacola and thence to Vera Cruz.

The Illinois Central railroad has announced its intention of calling upon coal producers to furnish fuel for its engines, which will commence running into the Birmingham district April 1. This system will handle a large quantity of coal from Alabama, not alone for its own use, but for the trade along its lines.

There is a better demand also for coke and the production is improving some.

Chicago

March 9—The coal market feels the approaching end of winter, orders being individually smaller, and no very cold weather being probable in Chicago territory. A few railroads are taking coal for storage, but few industrial plants are inclined to buy in any other way than for needs of the immediate future. Domestic supplies are also ordered only in expectation of changes in prices in April. Consumption of steam coals runs to the fine kinds, screenings being already in relatively much larger demand, while prepared sizes are suffering.

Illinois and Indiana coals hold to about the same prices as last week: Lump and egg, $1.90@2.60; run-of-mine, $1.70@1.80, and screenings $1.30@1.50. Brazil block is in light demand at $2.70@2.80. Coals from east of Indiana are in general steady, but not selling in any large amounts. Smokeless is weakest with a good deal on hand, selling at $3.15 for run-of-mine and $4.05 for lump or egg. Hocking is relatively strong at $3.15 Youghiogheny is firm, with sales light, at $3.15 for ¾-in. gas coal. Anthracite is in less demand.

Cleveland

March 10—Considerable interest is manifest in Cleveland coal circles over the coming convention of the American Federation of Miners in Indianapolis on March 12. Wholesale and retail dealers in this city got together last week and agreed, it is said, on a policy of protection. That is, the present output at the mines, instead of being decreased to meet the diminished demand due to curtailment in the manufacturing lines, will be increased to the greatest extent possible between now and April 1, when any new scale which the miners have agreed upon will go into effect. Certain it is, that with the opening of the week, coal was up 5c. a ton and all dealers were asking the same price—there was no cutting and scalping in the coal market.

The following prices are quoted on No. 8 district, Ohio: Slack, 75c.; mine-run, $1; ¾-in. lump, $1.10. Dealers say the market is becoming stronger.

Indianapolis

March 10—The demand for steam coal is increasing at the Indiana mines and is getting back to the amount of last fall. The mild winter has had its effect on the retail trade and dealers who are heavily stocked

with Indiana coal made a reduction of 50c. per ton during the past week. The operators deny the rumor that they have large quantities of coal at the mines in store. Only as much is mined each day as there are cars to load, when it is hoisted to the surface. It would take all the profit to dump it into storage and reload it later.

Pittsburg

March 10—There has been no improvement in the coal trade in this district, but the railroad mines are operating about as usual, an average of 30 per cent. of capacity. The Pittsburg Coal Company has a trifle over 40 per cent. of its mines running and nearly all the river mines are going. The high water interfered somewhat with operations last week. The rivers are not yet navigable. While the operators in this district have expressed a willingness to pay the present mining rate for another year, there may be some trouble when the existing agreement expires on March 31. The operators, however, will not concede an advance.

Connellsville Coke—There is no material change in the coke situation so far as prices are concerned, but production has fallen off somewhat. Prompt furnace coke is quoted at $1.75, but it is believed this price could be shaded. On contract the quotation remains $1.80@1.90. Foundry coke is still quoted at $2.25@2.40 for both spot and on contract. The *Courier* gives the weekly production for both fields at 157,982 tons. The shipments amounted to 6561 cars, distributed as follows: To Pittsburg, 2884 cars; to points west of Connellsville, 3312 cars; to points east of Connellsville, 365 cars.

Foreign Coal Trade

Exports of fuel from the United States for the month of January were, in long tons:

	1907.	1908.	Changes.
Anthracite	169,680	160,465	D. 9,215
Bituminous	591,690	745,484	I. 153,794
Total coal	761,370	905,949	I. 144,579
Coke	59,569	79,070	I. 19,501

Of the coal exports Canada took 154,502 tons anthracite and 409,858 tons bituminous; 564,360 tons in all, against 521,346 last year.

Imports of fuel for the month are reported as follows:

	1907.	1908.	Changes
Coal	145,981	155,026	I. 9,045
Coke	19,868	20,156	I. 288

The larger imports of coal this year were 108,418 tons from Canada and 31,123 from Australia.

Imports of coal into Spain during the year 1907 were 1,888,032 metric tons, a decrease of 311,065 tons as compared with 1906. Imports of coke were 246,545 tons, an increase of 18,444 tons.

Exports of fuel from Great Britain in January, with coal supplied to steamships in foreign trade, long tons:

	1906.	1907.	Changes.
Coal	4,624,741	4,677,800	I. 53,059
Coke	84,341	108,506	I. 24,165
Briquets	125,560	132,324	I. 6,764
Total exports	4,834,642	4,918,630	I. 83,988
Steamer coal	1,486,302	1,608,253	I. 121,951
Total	6,320,944	6,526,883	I. 205,939

Exports to the United States were 4043 tons in 1907, and only 1359 tons this year.

Imports and exports of fuel in France for the full year were, in metric tons:

Imports:	1906.	1907.	Changes.
Coal	14,308,207	14,868,990	I. 560,783
Coke	2,257,866	2,175,750	D. 82,116
Briquets	547,255	694,930	I. 147,675
Total	17,113,328	17,739,670	D. 626,342
Exports:			
Coal	1,373,109	1,165,400	D. 207,709
Coke	178,151	169,850	D. 8,301
Briquets	124,042	113,410	D. 10,632
Total	1,675,302	1,448,660	D. 226,642

Exports include fuel bunkered, or supplied to steamships in foreign trade which amounted in 1907 to 112,260 tons of coal and 68,780 tons of briquets.

Coal production in Belgium for the full year was 23,610,718 metric tons in 1906, and 23,824,499 in 1907; an increase of 213,781 tons, or 0.9 per cent.

Iron Trade Review

New York, March 11—We hear in various directions of some improvement in trade, but it is slow. The most encouraging point is found in the resumption of work on some new plants and on extensions of old plants. In most of these cases the work had been stopped before the end of the year.

In pig iron some buying is reported, but it is chiefly in small lots. Less has been sold to the pipe foundries, which seem to be supplied for the present. The majority of the furnaces are holding to the prices informally agreed upon, but some are offering iron at lower prices, and are securing business. This is especially the case with foundry iron. There is a rumor that sales have been made of 120,000 tons of Southern pig for export; but none of the larger companies will admit that it is party to such a transaction.

Finished material is quiet, but a few contracts for structural steel are coming forward. Contractors, however, are still holding back in the hope of securing concessions. It is beginning to be apparent that lower prices are needed to encourage any considerable revival of trade. A few additional orders for rails have been placed, but none of any considerable size.

Pig-iron Production—The number of anthracite and coke furnaces in blast on March 1 was 150, having a total weekly capacity of 267,500 tons; an increase of 35,000 tons over Jan. 1. Taking the estimate made by the *Iron Age*, with an allowance for the charcoal furnaces, the production of pig iron in February was 1,105,000 tons; and for the two months ended Feb. 29 it was 2,175,000 tons.

Baltimore

March 9—Imports for the week included 100 tons spiegeleisen, 372 tons ferro-manganese and 33 casks antimony. One cargo, 6000 tons, of manganese ore arrived from Bombay, India.

Birmingham

March 9—While the Southern iron manufacturers are not booking as much business now as they did a few weeks ago, there is no complaint made. All business that is being transacted now is in small lots, the consumers buying from hand to mouth. Reports are current that some large contracts are pending, but nothing definite is given out. The make in this district has been improved by the blowing in of furnace No. 1, Republic Iron and Steel Company, at Thomas, but it is understood that furnace No. 3, at the same place, is in need of repairing and will shortly be shut down. There is very little iron accumulated on the yards in the immediate Birmingham district. The Woodward Iron Company has let contracts for improvements of No. 1 furnace, the work to be completed this summer. The Birmingham Iron and Coal Company announces that the new furnace at Boyles, a few miles from Birmingham, will be ready for operation this summer.

Reports are current that quotations are around $13 per ton, No. 2 foundry, though inquiry at the various offices elicits the information that $13.50 per ton is being strictly maintained.

There is no improvement in conditions at foundries, machine shops or rolling mills. Considerable activity is noted around the steel plant at Ensley.

Chicago

March 9—The iron market continues dull, with sales of pig iron small and no general disposition to buy for the future. Carload lots to 300 tons are the only sales being made. Prices remain firm at $13 Birmingham for Southern No. 2 ($17 at Chicago) and $17.50 for Northern No. 2. Essentially the market is a waiting one for both melters and furnace agents, and both seem prepared to wait indefinitely. Rumors of large purchases of foundry iron occasionally spring up, but prove unfounded and are of importance only as showing that the trade is looking for such purchases to occur soon. The most encouraging feature of the situation is the tendency of the railroads to buy again. Building is not yet reviving. For com-

mercial shapes generally the demand is slowly increasing.

Coke is holding at $5.25 for the best Connellsville, with the demand very light, but shipments kept down to correspond.

Cleveland

March 10—Extreme dullness still characterizes the local pig-iron market. Valley furnaces are working on 50 per cent. of the total capacity. The following prices have been practically agreed to in the trade: Bessemer $17.90@18.90; No. 1, foundry, $17.85; No. 2, $17.35; No. 3, $16.85; No. 2 Southern $16,85@17.35; gray forge $16@16.85; Lake Superior charcoal (water freight rate basis) $22@23 per ton.

Philadelphia

March 11—A few of the Eastern Pennsylvania furnace companies are able to report a little more business than last month, but the improvement is not reflected in prices. The pressure for lower prices has no effect upon makers. Inquiries have been received this week for certain kinds of pig iron for delivery during the second quarter of the year, among which are pipemakers, who are not yet fully supplied, especially for the latter half of the year. The opinion seems to be gaining ground that there will be no decline in prices. This conviction is permeating the minds of the smaller buyers, and it explains the number of purchases made during the past week. While it is impossible to give quotations with mathematical exactness, it can be said the gray forge is salable at $16.50; No. 2 plain at $18 and No. 2 X foundry at $18.25.

Steel Billets—Steel billets are doing a little better than last week. Quotations for rolling steel are about $30: forging, $32.50@33.

Bars—The best reports today through the bar-iron offices are not encouraging and amount to about the same as they were a week ago. Mills are working in an irregular way, and anxiety exists for an increase in demand.

Sheets—No perceptible change is recognized in conditions. Quotations from 2.50@2.90c. for Nos. 18-28.

Pipes and Tubes—The pipe manufacturers are receiving a large amount of business for pipe-line construction, but the demand from this territory is very light. Prices for tubes are irregular and very little business is being done.

Plates—The plate mills are no better off and a shading of prices could be had by any of the large interests if they were disposed to take advantage of the anxiety of the manufacturers to get business.

Structural Material—Only small orders are coming along, but there are more of them than two or three weeks ago. Prices are maintained, but it is believed, though without any apparent reason, that some serious shadings will be made in order to stimulate demand.

Old Material—Old material has weakened in price, especially heavy melting steel and fire scrap. Railroad material is to be had at about $16; machinery cast at $15.50 per ton.

Pittsburg

March 10—The tin-plate market has brightened considerably and the cause of the recent slump has been explained. A number of the idle mills were started yesterday by the American Sheet and Tin Plate Company and it is now operating 67 per cent. of its capacity, or about 162 of its 242 tin mills.

There is but little change in the operation of the mills in this district. The Carnegie Steel Company is operating to a trifle more than 50 per cent. of capacity. All the plants of the Republic Iron and Steel Company in the Youngstown district are operating satisfactorily this week and some new business in small tonnages has been booked. The Jones & Laughlin Steel Company also is taking on some new business. Orders have been sent by this company to different concerns that are making machinery for the big new plant at Aliquippa to resume work on the machinery which had been discontinued last fall.

Some new business is being received in all of the finished lines, but in limited tonnages only. An active demand for wire and wire products continues and some new orders have been taken lately. There are some signs that business in structural material will come out shortly. Two good orders for line pipe are under negotiation. It is reported that each calls for 125 miles, ranging in sizes from 4 to 12 in.

Pig Iron—Another slump in pig iron has been recorded. Early in the week indications pointed to a stiffening of prices, but on March 5 an Ohio interest bought 5000 tons of No. 2 foundry for deliveries running over a period of six months at $15.50, Valley furnaces. This is a cut of 50c. from what was supposed to be the minimum price. Sales of bessemer iron are confined to carload lots and it is not known that $17, Valley furnaces, has been shaded. Basic iron continues strong at $16.90, Pittsburg. Midland furnace, which makes a fine grade of basic, was scheduled to close on Feb. 22, but on account of new orders being received the suspension was postponed to March 14. The first sale of gray forge in several weeks was closed a few days ago. It called for 300 tons and the price was $15, Valley furnace.

Steel—The large billetmakers are still strictly maintaining a price of $28 for both bessemer and open-hearth billets. Sheet-bars continue to be quoted at $29.50 delivered. Plates remain firm at 1.70c. and merchant steel bars at 1.60c.

Sheets—The improvement in sheets is slight. Some additional mills are running and prices seem to be firm. Black sheets are quoted at 2.50c. and galvanized at 3.55c. for No. 28 gage.

Ferro-Manganese—The market is unchanged, quotations remaining at $46.50 to $47 per ton.

Foreign Iron Trade

Exports of iron and steel and of machinery from Great Britain for the month of January are valued as follows, by the Board of Trade returns:

	1907.	1908.	Changes.
Iron and Steel.	£ 3,935,204	£ 3,231,811	D. £ 703,393
Machinery.....	2,473,236	2,684,187	I. 210,951
New Ships.....	628,880	666,876	I. 37,996
Total	£ 7,037,320	£ 6,582,874	D. £ 454,446

The total quantity of iron and steel exported was 453,350 tons in 1907, and 323,474 in 1908; decrease, 129,876 tons. Exports of pig iron to the United States this year were 3038 tons, a decrease of 36,501; of tin-plates 4703 tons, a decrease of 1197 tons.

Imports of iron and steel and of machinery for January were valued as follows:

	1907.	1908.	Changes.
Iron and steel.	£ 605,255	£ 523,524	D.£ 81,731
Machinery....	358,036	351,404	D. 6,632
Total.....	£ 963,291	£ 874,928	D.£ 88,363

Total quantities of iron and steel were 79,592 tons in 1907, and 66,844 in 1908; decrease, 12,748 tons.

Imports of iron ores for the month, in long tons:

	1907.	1908.	Changes.
Manganiferous ores..	31,850	9,624	D. 22,226
Iron ores.....	777,988	463,035	D. 314,953
Total.....	809,838	472,659	D. 337,179

Of the imports this year Spain furnished 3846 tons manganiferous and 352,430 tons iron ores.

Metal Market

NEW YORK, Mar. 11.

Gold and Silver Exports and Imports
At all United States Ports in Jan. and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Jan. 1908..	$ 444,200	$10,880,460	Imp.$10,436,260
" 1907..	2,450,072	3,270,505	" 820,433
Year 1908..	444,200	10,880,460	" 10,436,260
" 1907..	2,450,072	3,270,505	" 820,433
Silver:			
Jan. 1908..	4,148,844	3,468,716	Exp. $680,128
" 1907..	4,766,965	3,657,041	" 1,109,924
Year 1908..	4,148,844	3,468,716	" 680,128
" 1907..	4,766,965	3,657,041	" 1,109,924

Exports from the port of New York, week ended March 7: Gold, $84,765, chiefly to the West Indies; silver, $522,550, chiefly to London. Imports: Gold, $565,040, from Cuba and Central America; silver, $85,490, from Mexico and South America.

Specie holdings of the leading banks of the world March 7 are reported as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$265,288,700
England	$196,397,870	.....	196,397,870
France	551,739,440	$180,778,205	732,517,645
Germany	157,420,000	65,200,000	222,620,000
Spain	78,630,000	130,430,000	209,060,000
Netherlands	38,460,000	21,852,500	60,312,500
Belgium	19,833,335	9,916,665	29,750,000
Italy	182,955,000	23,000,000	205,955,000
Russia	580,360,000	30,845,000	611,205,000
Aust.-Hungary	232,375,000	63,110,000	295,485,000
Sweden	19,515,000	.....	19,515,000
Norway	7,500,000	.....	7,500,000
Switzerland	16,670,000	.....	16,670,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

The foreign trade of the United States in January is valued as follows by the Bureau of Statistics of the Department of Commerce and Labor:

Merchandise:	1907.	1908.
Exports	$ 189,296,944	$ 206,211,835
Imports	126,586,934	85,698,704
Excess, exports	$ 62,710,010	$ 120,513,131
Add excess of exports, silver		680,128
Total		$ 121,193,259
Deduct excess of imports, gold		10,436,260
Net export balance		$ 110,756,999

The gold and silver movement in detail is given in the table at the head of this column.

Gold and silver movement in France, year ended Dec. 31:

	1906.	1907.
Gold:		
Imports	Fr. 436,103,000	Fr. 492,336,000
Exports	165,617,000	154,572,000
Excess, imports	Fr. 270,486,000	Fr. 337,764,000
Silver:		
Imports	164,637,000	182,146,000
Exports	170,983,000	202,313,000
Excess, exports	Fr. 6,346,000	Fr. 20,167,000

Imports of copper and nickel coins were 123,000 fr. in 1906, and 108,000 fr. in 1907. Exports were 290,000 fr. in 1906, and 703,000 fr. last year.

The Treasury Department estimate of the money in the United States on March 1, 1908, is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 171,997,548	$ 633,804,057
Gold certificates	38,384,970	791,661,899
Silver dollars	19,347,757	86,539,225
Silver certificates	10,852,631	446,191,369
Subsidiary silver	16,075,711	127,388,912
Treasury notes of 1890	10,499	5,308,501
U. S. notes	9,627,701	337,053,315
Nat. Bank notes	30,955,156	664,719,363
Total	$297,251,973	$3,092,666,641

Population of the United States, March 1, 1908, estimated at 87,021,000; circulation per capita, $35.54. For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the treasury, and is not included in the account of money held as assets of the Government. This statement of money in the treasury as assets of the Government does not include deposits of public money in national-bank depositories to the credit of the treasurer of the United States, amounting to $219,543,719. The total amount in circulation March 1 was $1,696,058 less than on Feb. 1, but $201,945,419 greater than on March 1 of last year.

Silver Market

SILVER AND STERLING EXCHANGE.

Mar.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.	Mar.	Sterling Exchange.	Silver. New York, Cents.	Silver. London, Pence.
5	4.8660	55 1/16	25 7/16	9	4.8625	55 3/8	25 5/16
6	4.8650	55 3/8	25 5/16	10	4.8630	55 1/4	25 1/8
7	4.8625	55 1/2	25 1/8	11	4.8630	55 3/8	25 5/16

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

The silver market has fluctuated within a very small compass. India has, as usual, been taking the bulk of the business, though some amounts have been bought for China. Supplies are somewhat curtailed, but there is no serious reduction in output.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to Feb. 27:

	1907.	1908.	Changes.
India	£2,346,210	£1,041,338	D. £1,304,872
China	.....	451,400	I. 451,400
Straits	85,050	47,556	D. 37,494
Total	£2,431,260	£1,540,294	D. £ 890,466

Receipts for the week were £2000 from Australia, £6000 from the West Indies and £236,000 from New York; £244,000 in all. Exports were £73,500, all to India.

Indian exchange has been unchanged, the Council bills offered in London bringing an average of 15.91d. per rupee.

Mint purchases of silver, Feb. 26 to Feb. 29, were 213,300 oz.; average price, 55.762c. March 2 to March 6, 365,000 oz.; average, 55.890 cents.

Other Metals

Mar.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. Cts. per lb.	Spelter. New York, Cts. per lb.	Spelter. St. Louis, Cts. per lb.
5	12 3/8 @12 1/2	12 1/2 @12 3/8	57 1/4	30	3.65 @3.70	4.65 @4.70	4.50 @4.55
6	12 3/8 @12 1/2	12 1/8 @12 3/8	56 1/2	29 3/4	3.65 @3.70	4.65 @4.70	4.50 @4.55
7	12 3/8 @12 1/2	12 1/4 @12 3/8	.....	29 3/4	3.65 @3.70	4.60 @4.65	4.45 @4.50
9	12 3/8 @12 3/4	12 1/4 @12 1/2	57 3/4	29 3/4	3.65 @3.70	4.60 @4.65	4.45 @4.50
10	12 1/2 @12 3/4	12 1/4 @12 1/2	57 3/4	29 1/2	3.65 @3.70	4.60 @4.65	4.45 @4.50
11	12 1/2 @12 3/4	12 3/8 @12 1/2	57 3/4	29 1/2	3.65 @3.70	4.60 @4.65	4.45 @4.50

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—At last there seem to be indications of an improved demand for domestic consumption, which, coupled with some continued inquiry from abroad, has tended to produce a somewhat firmer market. However, the volume of business transacted has not been sufficiently heavy to bring about a material improvement. Up to Saturday last there were still anxious sellers of electrolytic, but since then there has been the improvement above noted. In Lake copper the market has been particularly dull, with comparatively little demand and, on the other hand, no general pressure to sell, many of the important producers holding entirely aloof. At the close prices are firm at 12½@12¾c. for Lake and 12⅜@12½c. for electrolytic in cakes, ingots and wirebars. The business in casting copper during the last week has been done at an average of 12⅛@12¼c., closing at 12¼@12⅜ cents.

Standard copper in London has been sluggish. The week opened with spot selling at £57 2s. 6d.; on Friday it declined to £56 10s.; sentiment was quite bearish, and some short sales took place. On Monday, owing to the somewhat better outlook, the shorts were led to cover and the market advanced to £57 15s. It remained at about this price for spot for the balance of the week. Three months copper closed at £58 2s. 6d.

Refined and manufactured sorts we quote: English tough, £53 10s.@54 10; best selected, £60 10s.@61 10; strong sheets, £63 10s.@64 10s.

Exports of copper from New York and Philadelphia for the week were 4322 long tons. Our special correspondent gives exports from Baltimore for the week at 802 long tons.

Copper Sheets and Wire—The base price for wire is 14½c. per lb. For sheets, cold rolled or hard, 18c.; hot rolled or soft, 17c. per pound.

Tin—The London market has retained its advance to the largest extent, and fluctuations throughout the week were small ones. The market closed steady at £134 for spot and £131 for three months.

The domestic market has been bare of any special features with the exception that spot tin is still at a slight premium over arrival tin. The close for spot material is 29½c., while tin due at the end of this week could probably be obtained at 29⅛c. per pound.

Lead—The market is very quiet and some parcels in the hands of speculators are still pressing for sale. Transactions have taken place at 3.65@3.70c., New York.

The London market has been somewhat firmer, Spanish lead selling at £13 17s. 6d. and English lead at £14 2s. 6d.

Spelter—The consumption in the galvanizing trade is reported to be slightly better, and manufacturers have still a plentiful supply; there is little new business offering. Prices have been some-

what lower, and at the close the market is quoted 4.60@4.65c., New York, and 4.45@4.50c., St. Louis.

The European market is slightly lower, good ordinaries being quoted at £20 17s. 6d. and specials at £21 5s. per ton.

Zinc Sheets—The base price is $7 per 100 lb.—less discount of 8 per cent.—f.o.b. cars at Lasalle and Peru.

Antimony—The market is weak and prices have receded somewhat because of liquidation by impatient dealers, although but little metal has been offered. Abroad, the situation is stronger and prices are firm. It is stated that even the cheapest brand of antimony cannot now be imported, all charges paid, at less than 8¼c. per lb. Quotations are 8⅞@9⅛c. for Cookson's, 8½@8¾c. for Hallett's and 7⅞@8⅛c. for ordinary brands.

Aluminum—The current price for No. 1 ingots, in ton lots, is 33c. per lb. For rods and wire, No. 0000 to 10, base price is 38c. For sheets, No. 13 to 24, B. & S. gage, base price is 40c. Tubes, 1¼ to 3½ in., base 50c. Higher prices are charged for small lots.

Cadmium—The price is $1.25 f.o.b. Cleveland in 100-lb. lots. A higher price is asked for smaller lots.

Nickel—For large lots, New York, the chief producer quotes 45@50c. per lb. according to size and terms of sale. For small quantities, 50@65c., same delivery.

Quicksilver—New York quotations are $45 per flask for lots of 100 flasks or over, and $46 for smaller orders. San Francisco quotations are $44.50@45.50 for domestic orders; for export nominal, at about $1.50 lower. The London price is £8 5s. per flask, with £8 3s. 9d. quoted from second hands.

Platinum—There were no new developments in the platinum market. Quotations remain $28 per troy oz. for hard platinum, $25.50 for ordinary, and $17 for scrap.

Missouri Ore Market

Joplin, Mo., March 7—The highest price paid for zinc was $41 per ton, the assay base ranging from $36 to $37.50 per ton of 60 per cent. zinc, and all grades averaging $35.26 per ton. The highest price paid for lead was $50 per ton, medium grades selling from $48 to $49 per ton, and all grades averaging $49.94. A large portion of this ore was sold at a higher rate last week for this week's delivery, prices this week declining.

The zinc shipment this week includes the sales from one company that have been withheld for six weeks, making the extraordinary showing as it is.

Some purchasing agents have contended at the close of each week during the past four weeks, that zinc prices must be lowered, as the smelters cannot afford to pay present prices on the present market quotations for spelter. Others appreciate the situation enough to know that prices cannot be lowered without reducing the output materially. As it is the average output this year has been 4110 tons per week, with an average of 500 tons per week from the Wisconsin district. This is a total of 4610 tons of zinc ore, or approximately 2378 tons of spelter, per week, against an average production of 4744 tons of spelter per week last year. This figure is 50 per cent. of the average production of last year.

Following are the shipments of zinc and lead from the various camps of the district for the week ending March 7:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	6,221,590	1,244,440	$143,099
Joplin	2,601,610	350,820	57,150
Duenweg	757,880	78,650	15,607
Galena	533,700	154,400	13,467
Prosperity	555,640	8,400	10,210
Oronogo	498,240	.....	8,937
Granby	660,000	68,000	8,700
Badger	323,310	53,210	7,796
Spurgeon	339,340	44,820	5,091
Alba-Neck	235,680	.....	4,594
Aurora	262,220	.....	4,354
Sarcoxie	141,960	.....	2,555
Carthage	104,480	.....	2,037
Carl Junction	56,940	7,920	1,279
Zincite	48,620	.....	875
Wentworth	41,020	.....	738
Totals	13,382,230	2,020,660	$286,489
10 weeks	82,207,860	11,692,860	$1,734,778

Zinc value, the week, $236,018; 10 weeks., $1,450,483
Lead value, the week, 50,471; 10 weeks., 284,295

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	34.92	February	84.58	49.72
March	48.66	.....	March	82.75	.....
April	48.24	.....	April	79.76	.....
May	45.98	.....	May	79.56	.....
June	44.82	.....	June	73.66	.....
July	45.79	.....	July	58.18	.....
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Wisconsin Ore Market

Platteville, Wis., March 7—The highest price paid for zinc ore this week was $39, on a basis of $37.50 per ton of 60 per cent. zinc ore. Lead ore sold at $24 per thousand for 80-per cent. lead. The Federal Lead Company has again entered the field for the purchase of lead ore.

Shipments from the district, week ended March 7:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Benton	557,960	141,000	.....
Platteville	486,100	.....	.....
Hazel Green	172,300	110,750	.....
Livingston	170,000	.....	.....
Galena	160,000	.....	.....
Mineral Point	.....	65,000	.....
Linden	.....	119,000	.....
Total	1,546,360	435,750	.....
Year to Mar. 7	12,608,920	619,110	.....

The machinery is adjusted at the new electrostatic separator at Platteville, and the initial ore purchase for this plant was made today.

Chemicals

New York, March 11—The general market is lifeless and business is confined to immediate needs. A number of inquiries are coming in for April-May deliveries, but buyers are timid and no business has resulted.

Copper Sulphate—Inquiries are being received more freely and the export trade is looking up. There is still a decided hesitancy on account of the weakness in the metal market. Prices remain unchanged at $5 per 100 lb. for carloads and $5.25 for smaller lots.

Nitrate of Soda—The market is quiet and business is confined to the consumers of fertilizers. The powder manufacturers are buying only in small amounts. Prices remain unchanged. Quotations are, for 95 per cent., 2.40c. for all positions of 1908, and 2.37½c. for 1909. The 96 per cent. grade sells 7½c. per 100 lb. higher.

Phosphate Rock—J. M. Lang & Co., Savannah, Ga., report shipments of Florida phosphate rock, through the port of Savannah in February, at 4548 tons to Holland and Germany. Paul C. Trenholm, Charleston, S. C., reports shipments of South Carolina rock, by rail, at 4640 tons in January.

Mining Stocks

New York, March 11—The general stock markets have shown decided improvement during the week, partly due to inside support of some leading stocks, and partly to covering of some large short interests. With the rise, the public is reported to be coming in, but this is true only to a limited extent. At the close there was a slight reaction, but it leaves prices higher than they were a week ago.

The curb market has followed the lead of the Exchange, but business has not been active except in a few stocks. Cumberland-Ely and Consolidated Arizona Smelting were dealt in rather heavily. Other coppers were quiet. The Goldfield and Cobalt stocks were firmer in tone, but on moderate dealing.

Boston

March 10—The reduction of the Calumet & Hecla quarterly dividend to $5 had a temporary depressing effect on the mining-share list last week, mainly in this particular issue. This has been partially forgotten and buoyancy to a more or less degree is now manifest under the impetus that comes from the strength of Amal-

gamated Copper which is derived from the trading in New York. Calumet & Hecla broke $80 a share to $565 ex-dividend, since recovering to $595. Even though there was sympathetic weakness in the balance of the list, offerings of stocks otherwise were light.

North Butte, Butte Coalition, Old Dominion and Utah Consolidated have been the most active features the past week. North Butte fell $1 to $49, but subsequently touched $51.37½. The company is increasing its ore shipments to the Washoe smelter.

The curb has been fairly active, with some new stocks appearing. The features have been Nipissing and Davis-Daly, which have displayed strength.

STOCK QUOTATIONS

NEW YORK Mar. 10	
Name of Comp.	Clg.
Alaska Mine	1/8
Am.Nev.M.&P.Co.	....
Amalgamated	52
Anaconda	32⅞
Balaklala	2
British Col. Cop.	4¼
Buffalo Cobalt	....
Butte & London	....
Butte Coalition	20¼
Butte Cop. & Zinc	....
Cobalt Contact	....
Colonial Silver	5/8
Cum. Ely Mining	7¾
Davis Daly	4¼
Dominion Cop	2⅛
Douglas Copper	6⅛
El Rayo	1⅝
Foster Cobalt	.67
Furnace Creek	.24
Giroux Mine	3⅜
Gold Hill	¾
Granby, New	....
Greene Gold	1
Greene G. & S	1/16
Greenw'r & D.Val.	.75
Guanajuato	2⅛
Guggen. Exp.	145
Hanapah	.20
McKinley Dar.	.66
Micmac	3⅝
Mines Co. of Am.	1⅜
Mitchell Mining	1/16
Mont.Sho. C.(New)	2
Nev. Utah M. & S.	3⅛
Newhouse M. & S.	7¾
Nipissing Mines	6⅞
Old Hundred	¾
Silver Queen	1⅛
Stewart	¾
Tennessee Cop'r.	....
Union Copper New	1/16
Utah Apex	4¼
Utah Copper	25¼
West Columbus	....

N. Y. INDUSTRIAL	
Am. Agri. Chem	17½
Am. Smelt. & Ref.	63½
Am. Sm. & Ref., pf.	93¾
Bethlehem Steel	....
Colo. Fuel & Iron	17⅞
Federal M. & S.,pf.	....
Inter. Salt	10½
National Lead	48⅞
National Lead, pf.	91⅞
Pittsburg Coal	....
Republic I. & S.	17
Republic I.& S.,pf.	69
Sloss-Sheffield	46
Standard Oil	515
Tenn. C. & I	....
U. S. Red. & Ref.	....
U. S. Steel	32⅜
U. S. Steel, pf	95½
Va. Car. Chem	16½
Va. I. Coal & Coke	....

ST. LOUIS Feb. 29		
N. of Com.	High.	Low.
Adams	.25	.20
Am. Nettie	.03	.02
Center Cr'k	2.00	1.50
Cent. C. & C.	64.00	62.00
C.C. & C. pd.	75.00	73.00
Cent. Oil	100.00	90.00
Columbia	5.00	3.00
Con. Coal	18.00	16.00
Doe Run	130.00	120.00
Gra. Bimet.	.25	.20
St. Joe	15.00	13.00

BOSTON Mar. 10	
Name of Comp.	Clg.
Adventure	1½
Allouez	27
Am. Zinc	22½
Arcadian	4
Atlantic	11
Bingham	.75
Boston Con	14⅞
Calumet & Ariz	100½
Calumet & Hecla*	595
Centennial	23
Con. Mercur	.30
Copper Range*	61¼
Daly-West	....
Franklin	8
Greene—Can.	8¼
Isle Royal	20¾
La Salle	14½
Mass	....
Michigan	....
Mohawk	49½
Mont.C.&C. (new).	.80
Nevada	9⅞
North Butte	50
Old Colony	....
Old Dominion	36¼
Osceola	83
Parrot	17
Phoenix	....
Quincy*	84
Rhode Island	3½
Santa Fe	2
Shannon	10¾
Superior	16½
Tamarack	65
Trinity	14¼
United Cop., com.	....
U. S. Oil	....
U. S. Smg. & Ref.	29
U.S.Sm. & Re.,pd.	38½
Utah Con	38½
Victoria	3⅛
Washington	....
Winona	....
Wolverine	125
Wyandotte	....

*Ex. Div. †Ex. Rights.

BOSTON CURB	
Ahmeek	....
Ariz. Com	....
Black Mt.	4⅛
East Butte	5
Hancock Con	....
Keweenaw	5
Majestic	1⅝
Raven	1¼
Shawmut	.48
Superior & Pitts.	12¼
Troy Man	....

LONDON Mar. 11			
Name of Com.	Clg.		
Dolores	£1	2s	6d
Stratton'sInd.	0	2	6
Camp Bird	0	13	1½
Esperanza	1	1	3
Tomboy	1	8	9
El Oro	1	1	10½
Oroville	..	..	.
Somera	..	..	.
Utah Apex	..	..	.
Ariz. Cop.,pfd.	..	..	.
Ariz. Cop.,def.	..	..	.

Cabled through Wm. P. Bonbright & Co., N.Y.

NEVADA STOCKS. March 11.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
TONOPAH STOCKS	
Belmont	1.27½
Extension	1.00
Golden Anchor	.04
Jim Butler	.33
MacNamara	.36
Midway	.67
Montana	1.65
North Star	.15
Tono'h Mine of N.	5.50
West End Con	.22
GOLDFI'D STOCKS	
Adams	.05
Atlanta	.28
Blue Bell	.10
Blue Bull	.17
Booth	.23
Columbia Mt.	.21
Comb. Frac	.74
Cracker Jack	.09
Dia'dfield B. B. C.	.19
Goldfield Belmont	.15
Goldfield Con	5.12½
Goldfield Daisy	1.12
Great Bend	.38
Jumbo Extension	.41
Katherine	.05
Kendall	.14
Lone Star	.10
May Queen	.09
Oro	.11
Red Hill	.27
Roanoke	.02
Sandstorm	.27
Silver Pick	.26
St. Ives	.37
Triangle	.08
BULLFROG STOCKS	
Bullfrog Mining	.07
Bullfrog Nat. B.	.11
Gibraltar	.11
Gold Bar	.33

Name of Comp.	Clg.
Homestake King.	.35
Montgomery Mt.	.10
Mont. Shoshone C.	2.62½
Original Bullfrog.	.03½
Tramp Cons.	.20
MANHAT'N STOCKS	
Manhattan Cons.	.17
Manhat'n Dexter.	.10
Jumping Jack	.06
Stray Dog	.08
Indian Camp	.05
MISCELLANEOUS	
Golden Boulder	.08
Hayseed	.10
Lee Gold Grotto	.10
Nevada Hills	3.00
Nevada Smelting.	1.00
Pittsburgh S. Pk.	1.22
Round Mt. Sphinx	.29

COLO. SPRINGS Mar. 7	
Name of Comp.	Clg.
Acacia	6¼
Black Bell	3
C. C. Con	3¼
Dante	7
Doctor Jack Pot.	7
Elkton	51⅝
El Paso	32
Findlay	....
Gold Dollar	7½
Gold Sovereign	3½
Isabella	37½
Index	....
Jennie Sample	....
Jerry Johnson	....
Mary McKinney	....
Pharmacist	....
Portland	1.05
Un. Gold Mines	5
Vindicator	80
Work	14

New Dividends

Company.	Payable.	Rate.	Amt.
Am. Smelters, pfd.A	Mar. 2	$1.50	$255,000
Am. Smelters, pfd.B	Mar. 2	1.25	375,000
Bunker Hill & Sullivan	Mar. 4	0.20	60,000
Calumet & Hecla	Mar. 31	5.00	500,000
Copper Range Con	Apr. 1	1.00	383,781
Doe Run	Mar. 15	0.50	29,531
Dominion Coal, com	Apr. 1	1.00	150,000
Federal Smg., pfd	Mar. 16	1.75	210,000
Florence (Goldfield)	Apr. 1	0.10	125,000
Gen. Chemical, pfd	Apr. 2	1.50	150,000
Gt. Nor. Iron Ore	Mar. 16	1.00	1,495,720
Guggenheim Exp.	Apr. 7	2.50	262,500
Mexico Con. M & S	Mar. 10	0.25	60,000
National Lead, pfd	Mar. 16	1.75	265,820
N. S. St. & Coal, com	Apr. 15	1.50	74,814
N. S. St. & Coal, pfd	Apr. 15	2.00	20,600
Quincy	Mar. 23	1.50	165,000
Republic I. & S., pfd	Apr. 1	1.75	357,296
Sloss. Sheff., com	Mar. 2	1.25	125,000
Standard Oil	Mar. 14	15.00	14,550,000
St. Joseph	Mar. 20	0.15	150,000
United Verde	Mar.	0.75	225,000
Wolverine	Apr. 1	5.00	300,000
Work	Apr. 4	0.01	15,000

Assessments

Company.	Delinq.	Sale.	Amt.
Blackjack Con., Utah	Feb. 20	Mar. 16	$0.03
Burlington, Utah	Feb. 17	Mar. 5	0.01
Butte & Yerrington, Nev.	Mar. 25	Apr. 16	0.02
Caledonia, Nev.	Mar. 10	Apr. 1	0.10
Challenge, Nev.	Feb. 25	Mar. 17	0.10
Con. Imperial, Nev.	Mar. 11	Apr. 2	0.01
Duleek, Cal.	Mar. 6	Mar. 23	0.05
Eastern & Western, Utah	Mar. 16	Apr. 6	0.01
Exchequer, Nev.	Feb. 27	Mar. 19	0.05
Golden Fleece, Cal.	Feb. 8	Mar. 7	2.50
Hannapah, Utah	Feb. 6	Mar. 10	0.01
Jenny Lind, Cal.	Mar. 10	Mar. 26	0.02
Julia, Nev.	Feb. 24	Mar. 18	0.03
Quincy, Jr., Utah	Mar. 21	Apr. 20	0.02
Scottish Chief, Utah	Mar. 18	Apr. 10	0.01
Skylark, Utah	Mar. 27	Apr. 14	0.01
Sierra Queen, Cal.	Mar. 15	Apr. 3	0.02
Trumbull Oil, Cal.	Feb. 24	Mar. 24	0.01
Union Con., Nev.	Mar. 2	Mar. 26	0.10
Western Mines, Nev.	Mar. 16	Apr. 23	0.01½

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	.....	31.325	.....
April	65.462	.....	30.253	.....
May	65.981	.....	30.471	.....
June	67.090	.....	30.893	.....
July	68.144	.....	31.366	.....
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	.....	25.560	.....	106.594	.....
April	24.224	.....	25.260	.....	98.625	.....
May	24.048	.....	25.072	.....	102.375	.....
June	22.665	.....	24.140	.....	97.272	.....
July	21.130	.....	21.923	.....	95.016	.....
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	.....
February	42.102	28.978	August	37.667	.....
March	41.313	.....	September	36.689	.....
April	40.938	.....	October	32.620	.....
May	43.149	.....	November	30.833	.....
June	42.120	.....	December	27.925	.....
			Av. year	38.166	.....

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	.....	19.703	.....
April	6.000	.....	19.975	.....
May	6.000	.....	19.688	.....
June	5.760	.....	20.188	.....
July	5.288	.....	20.350	.....
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	.....	6.687	.....	26.094	.....
April	6.685	.....	6.535	.....	25.900	.....
May	6.441	.....	6.291	.....	25.563	.....
June	6.419	.....	6.269	.....	25.469	.....
July	6.072	.....	5.922	.....	23.850	.....
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.